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Water Monitoring, Assessment &
Protection Division

MEMORANDUM

TO: Rob Devlin **CLIENT-MATTER NO.:** 051391-00006

FROM: Mary D. Shahid MDS
Tommy Lavender

DATE: February 14, 2019

RE: Maguro Enterprises, LLC
Permit Application Modification

On behalf of Maguro Enterprises, LLC, please find attached permit application and supporting information requesting an increase in the existing groundwater withdrawal permit from **.5** MGD to **1.5** MGD.

If you have any questions or need any additional information regarding this request, the following individuals, who are located at the Google Campus in Moncks Corner, S. C., are the designated contacts for purposes of the permit application and are available to assist you:

Jason Jenkins, P.E., DCS Manager
jjjenki@google.com
650.335.8596

Bret Griffin, P.E. Leed AP, Sr. Data Center Mechanical Engineer
brettgriffin@google.com
650.861.5742

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FEB 15 2019

Water Monitoring, Assessment & Protection Division

February 13, 2019

Rob Devlin
Groundwater Management Section
S. C. Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Subject: **Water Withdrawal Permit Application Modification Maguro Enterprises, LLC, Moncks Corner, Berkeley County, South Carolina**

Dear Mr. Devlin:

On behalf of Maguro Enterprises, LLC, ("Maguro"), please find attached an application seeking authorization to increase the existing water withdrawal permit issued by the Department of Health and Environmental Control (DHEC) from 0.5 million gallons per day (MGD) to 1.5 MGD for its facility at Moncks Corner, South Carolina. The attached permit application is intended to provide technical support for the proposed increase, and to address the requirements of the "Groundwater Management Plan for the Trident Capacity Use Area" (the "Plan") that was approved by DHEC on May 11, 2017.

In support of the request to increase Maguro's permitted withdrawal from 0.5 MGD to 1.5 MGD, please find the following items and considerations:

- Application for Groundwater Withdrawal Permit (Form D-2504) for a proposed diversion of 1.5 MGD from Well TW-1 for use as non-contact cooling water. Includes Figure 1 that indicates the location of Well TW-1 and nearby roadways as per Item 15 of the Application.
- A report entitled *Berkeley County Data Center Expansion Water Needs, August 2017* prepared by Maguro Enterprises, LLC - Berkeley County. This report includes the following appendices:
    - Appendix I - *Water Supply Alternative Analysis, September 2017* prepared by FOX Engineering Associates, Inc.
    - Appendix II - *Hydrogeologic Report for Support of Groundwater Withdrawal Permit Application for 1.5 MGD for Well TW-1, Moncks Corner, South Carolina, July 2017* (the Hydrogeologic Report) prepared by WSP USA (formerly Leggette, Brashears & Graham).
    - Appendix III - *Best Management Plan* prepared by Maguro Enterprises, LLC – Berkeley County.

wsp

- Appendix IV - Testimonials

If you have any questions or need additional information, please feel free to contact us.

Very truly yours,

Karen Benson, P.G.
Lead Hydrogeologist

Frank Getchell, P.G. (SC GEO. 2673)
Senior Supervising Hydrogeologist/
Office Manager

Encl.
cc: Maguro Enterprises, LLC
FOX Engineering Associates, Inc.
file

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DHEC
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Water Monitoring, Assessment & Protection Division

Application for Groundwater Withdrawal Permit
Bureau of Water

A. General Information.

1. Facility Name: Maguro Enterprises, LLC

2. Owner: Maguro Enterprises, LLC	7. Contact: Paul Carff
3. Owner Address: 1669 Garrott Avenue City: Moncks Corner State: South Carolina Zip: 29461	8. Contact Address: 1669 Garrott Avenue City: Moncks Corner State SC Zip: 29461
4. Owner Telephone Number:	9. Contact Telephone Number: (843) 719-3320
5. Owner Fax Number:	10. Contact Fax Number:
6. E-mail Address:	11. E-mail Address:

12. Type of Application: ☐ New ☐ Modification

13. Total Requested Withdrawal Rates.

A. Million gallons Per Month: 46.50 B. Million gallons Per Year: 549.00

14. Purpose of Groundwater Withdrawal: (please indicate number of wells beside description which best applies, total below should equal total number of wells owned).

Water Supply (WS)	Number:	Industrial (IN)	Number: 1
Golf Course Irrigation (GC)	Number:	Aquaculture (AQ)	Number:
Agricultural Irrigation (AI)	Number:	Other (OT)	Number:

15. With this application include a road map showing the site location, (please make sure all roads leading to the site entrance are labeled).

16. With this application include a detailed site map with the location of all wells planned to be used for any type of groundwater withdrawal. Each existing and proposed well must include an owner ID on the map.

A. If groundwater wells are to be used for any type of irrigation the site map must include irrigated fields, which source will be irrigating specific fields, vegetation type, and total acres of each field.

17. The original application along with site and location maps must be mailed to SCHEC, 2600 Bull Street, Columbia, SC 29201, Groundwater Management Section.

An application guidline, permitting process outline, and a brief summary of the Groundwater use and Reporting Act is included with this application. The Groundwater use and Reporting Act summary provides the owner with a brief description of the laws that govern this application. The guideline is provided to help the applicant correctly complete the application. The outline provideds a list of steps to be completed by the applicant and the Department. It is important that these steps be followed closely, because no action will be taken by the Department until each step in the outline is completed and correct. If any information received is not correct then the party in charge of the permitting will be informed. If the required information is not received, or is late, and the Department is not notified atleast 15 days prior, The permit may be delayed, denied, or revoked.

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18. Complete the following table for proposed wells.						
Owner ID	**Latitude**	**Longitude**	**Depth**	**Screened/Open Interval**	**Est. Yield (In GPM)**	**Flow Measurement Method**
1) TW-1				1582-1597		
2) TW-1 continued	33.06	-80.05	1682	1612-1682	2,400+	Orifice weir
3)						
4)						
5)						
6)						
7)						
8)						

19. Complete the following table for all wells. Use abbreviations provided on previous page for Type of Use.			
Owner ID	**Type of Use**	**Max. monthly withdrawal rate (in million gallons)**	**Max. yearly withdrawal rate (in million gallons)**
1) TW-1		46.50	549.00
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
11)			
12)			
13)			
14)			
15)			
16)			
17)			
18)			

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20. Please complete the following table for all other sources of water.

Owner ID - Purchased, Effluent, or Surface Water	Type of Use	Million gallons per month	Million gallons per year
Purchased	WS	Facility not complete	- to be determined
Purchased	IN	Facility not complete	- to be determined
Surface Water (Storm water)	IN	Facility not complete	- to be determined

21. Please describe any groundwater conservation methods that are in implemented or will be implemented within the next two years. (These include but are not limited to such practices as highly efficient equipment, wetting agents, other water sources, groundwater recycling, withdrawing from alternate aquifers, maintaining equipment, etc).

Water conservation is a priority in our operations. We harvest rainwater onsite and use it for cooling, so as to reduce the amount of groundwater required. We maximize the number of times that water is recycled within the facility. We test water quality regularly to ensure that equipment is operating as expected, and that recycling rates are as high as possible.

B. Irrigation.

Field / Course ID	Vegetation	Acres
1)		
2)		
3)		
4)		
5)		
6)		
7)		
8)		
9)		
10)		
11)		
12)		
	Total Acres Irrigated:	0.00

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C. Industrial

1. Describe your operation, including the types of products produced, and the uses for groundwater in the industrial process. Please include reason to use groundwater rather than alternative sources of water.

The groundwater requested for withdrawal in this application will be used for non-contact cooling water.

The decision to pursue a groundwater source for use for this operation included both an evaluation of potential aquifer capacity availability, and suitability for meeting the proposed water needs. The proposed use of on-site groundwater from a deep confined aquifer as the supply source was selected in order to afford access to a controllable source, which exhibits relatively consistent temperature and chemistry properties appropriate for the on-site cooling water system.

2. Please Estimate to the best of your ability the volume of groundwater to be withdrawn and used for each industrial process. i.e. If you have 3 seperate cooling processes, please list them seperately by a known name such as 1,2,3, etc.

Process ID	Million gallons per month	Million gallons per year
Processing:		
Cleaning:		
Cooling:	46.50	549.00

D. Signature.

I certify the information enclosed is true, complete, and that conservation measures will be researched and enacted when economically feasable.

Paul Carff Printed/Typed Name	Facilities Manager/Authorized Signatory Title
Signature	Date (MM/DD/YYYY)

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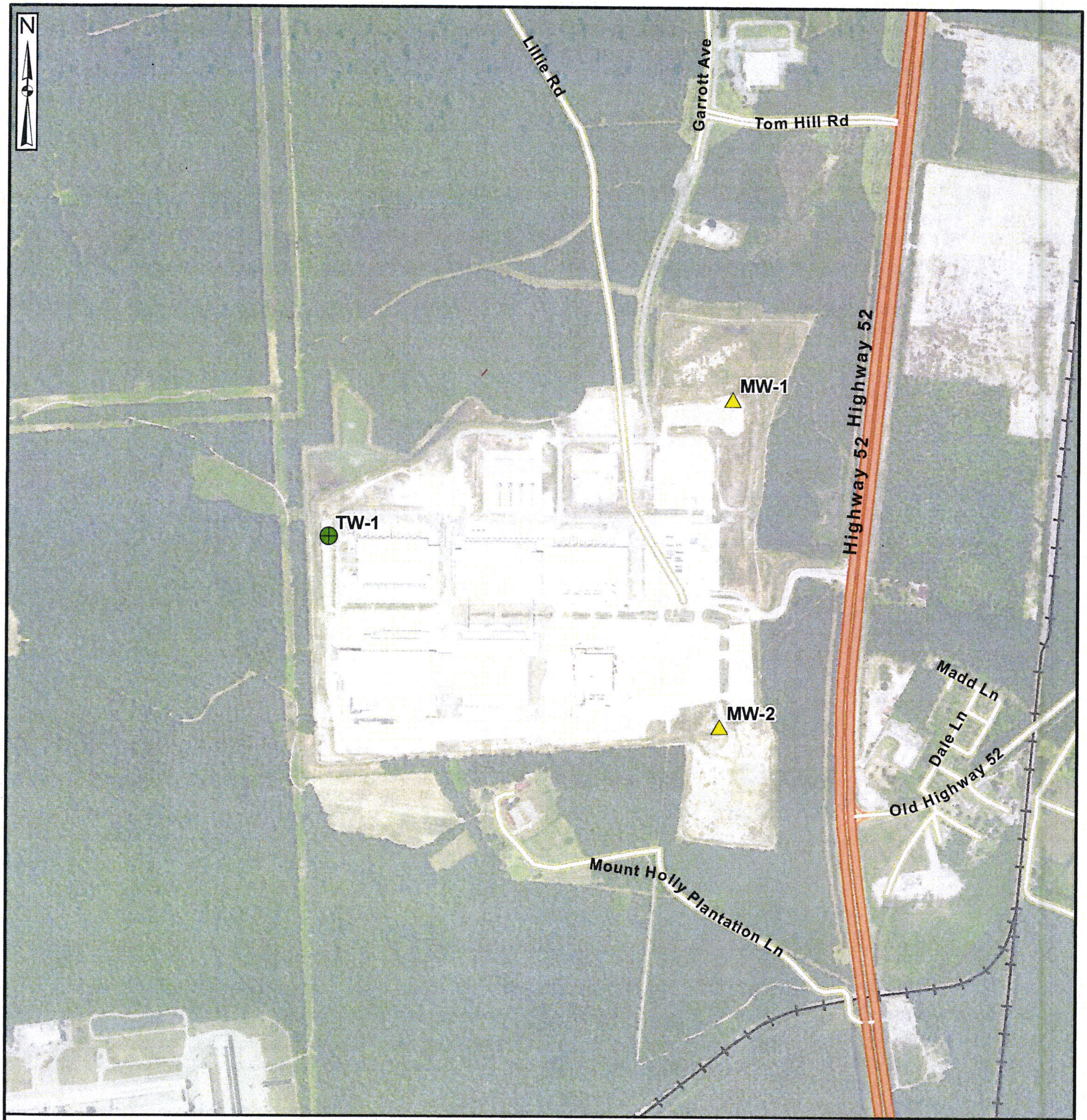

1,000 500 0 1,000 Feet

Legend

- Test Well
- Observation Well

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

TEST WELL AND MONITOR WELL LOCATIONS

Prepared by:

Leggette, Brashears & Graham, Inc.
Professional Groundwater and Environmental Services
600 East Crescent Avenue, Suite 200
Upper Saddle River, New Jersey 07458
(201) 818-0700 www.lbgweb.com

DATE: 07/15/16

FILE: B:\MNK\gis\Site Location | DRAWN BY: ZT | CHECKED BY: KB | FIGURE: 1

Supplement to the Application for Groundwater Withdrawal Permit

Table of Contents

Berkeley County Data Center Expansion Water Needs

Maguro Enterprises, LLC

I. EXECUTIVE SUMMARY

This report summarizes the due diligence and engineering analysis that was performed by FOX Engineering for the Maguro groundwater permit increase request from 0.5 MGD (Million Gallons per Day) to 1.5 MGD.

Additional make-up water supply is needed for process cooling purposes at the Maguro data center facility located in Berkeley County to support a significant expansion in size and operations of the site. Without additional water supply, the site will not be able to expand. Several water supply options were thoroughly investigated as part of the due diligence of this request and additional groundwater supply was determined the only viable solution based on screening criteria of: availability, consistency, reliability, and sustainability. Details of the associated Alternatives Analysis can be found in Appendix I.

Other sources investigated included: additional potable utility supply, off-site greywater reuse, on-site stormwater reuse expansion, and new surface water direct feed systems. Although Maguro will reconsider some or all of these options for future needs, each was determined not feasible for the immediate need based on the screening criteria.

Maguro takes great pride, value, and effort in minimizing its need for, and optimizing the usage of, all natural resources. Water based cooling is utilized at the Berkeley County data center to minimize the facility's energy footprint. Over 99% of the site's water usage is dedicated to evaporative-cooling the heat generated by the data centers. The remaining less than 1% is used for domestic supply for our people. Evaporative-cooling allows the site to reduce the overall energy consumption by as much as half compared to the majority of other operating data centers today. During the cooling process, the water will be recycled repeatedly until almost all of it has evaporated. To support this recycling, a new technology will be used to treat the incoming groundwater supply to allow for nearly 100% usage efficiency with nearly zero wastewater production. A pilot test of this technology has been in operation at the facility for more than a year with great success. More information on this Best Management Plan can be found in Appendix III.

The results of this analysis indicate that a selection of groundwater supply for this application meets the requirements of a "Reasonable Use" as defined by SCDHEC in the Initial Groundwater Management Plan for the Trident Capacity Use Area. The following criteria support this determination:

- The proposed water use is not only beneficial but essential to the facility
- There are no other water sources that meet the required criteria
- Nearly 100% usage efficiency of the groundwater for its intended purpose
- Virtually no wastewater
- Sustainable capacity of the Middendorf aquifer to support this application

Lastly, groundwater has additional benefits over the other considered options which provide the site with growth potential to be one of Maguro's single largest data center sites in the world, creating further jobs and investment in South Carolina. See Part II below for additional details on Maguro's investment, job creation, and community contributions in Berkeley County. Unlike the other water supply options, the local groundwater yield is not strictly limited or constrained by a peak daily or instantaneous flow capacity. Due to the critical nature of the facility, water reservations are based on rarely occurring peak day demands. The implementation of a groundwater supply with relatively flexible usage constraints allows Maguro to coordinate reservation needs through their utility provider on a much more manageable and realistic scale which ultimately benefits both parties.

II. MAGURO (GOOGLE) PRESENCE

Google is proud to call Berkeley County and South Carolina home to our data center. When we first announced our plans to build in Berkeley County in 2007, we did so knowing that we would expand our operations. We've invested $1.8 billion in the facility and have made a long-term commitment for a further $600 million to the region and the state as announced in September 2018. We currently employ more than 400 employees and contractors. During peak construction activities, there are more than 2,000 contractors on site.

We've awarded more than $2 million to local schools and nonprofits and have provided free wi-fi networks in six parks and community gathering spaces in Charleston, Summerville, Moncks Corner and Goose Creek. As we continue to grow in the Palmetto State, we've supported technology education, empowered local small businesses through online tools and support, and helped build a culture of innovation in the Lowcountry.

We're committed to building interest in STEM (science, technology, engineering and math) education with a focus on computer science, and engaging with local students, alumni and faculty to build strong relationships with the academic community. Our support for education efforts includes: In 2016, Berkeley County Schools became South Carolina's first school system to have a Rolling Study Hall—an initiative to provide Internet access and devices for students with long commutes to rural communities. Our annual "Storm The Citadel Trebuchet Competition" in partnership with The Citadel Foundation since 2011 is a competition that brings together thousands of local students, Citadel cadets, engineers, scientists and executives to build and launch trebuchets (similar to medieval catapults) applying STEM principles.

In 2016, we provided more than $1.56 billion of economic activity for South Carolina businesses, website publishers, and non-profits and $4.5 million of free advertising to South Carolina non-profits through the Google Ad Grants program. Last year, 15,000 South Carolina businesses, website publishers, and non-profits benefited from using Google's advertising tools, AdWords and AdSense.

Google will fund The Belle W. Baruch Foundation to support and expand on-going research at Hobcaw Barony, a 16,000-acre property dedicated to coastal watershed research and education. This research funding will help to support improved monitoring, understanding and management of groundwater resources in the greater Charleston area.

In the wake of Hurricane Matthew, Google teamed up with the SC Department of Transportation to evacuate more than 1 million residents on the South Carolina coast. Working closely with SCDOT, our Crisis Response Team of engineers provided timely updates to Google Maps regarding closed roads, bridges and available shelter (included in Appendix IV). Most recently, we were informed that Google will receive the 2017 SC School Boards Association's Champion for Public Education Award for our "invaluable contributions of time and resources to support public schools. Google serves as a role model for all of South Carolina." (included in Appendix IV).

To keep this data center growing, we need water to cool it. We explored many options, from surface water to greywater, but determined that each of these sources would be either insufficient in capacity, unreliable, or take many years to access. Therefore, we turned to a groundwater source that was plentiful and renewable, and that could be utilized responsibly (see Appendix I).

The Middendorf (aka McQueen Branch) aquifer meets these criteria. It's essentially an extensive underground layer of sand that serves as a conduit for groundwater originating along the Fall Line to pass under the Low Country of the South Carolina Coastal Plain that empties into the Atlantic Ocean east of Charleston. Before we submitted our application to withdraw groundwater from this aquifer, we brought on expert hydrogeologists from WSP USA [formerly Leggette, Brashears & Graham (LBG)] to study the groundwater supply potential of the area using hydrogeologic and well construction data available from State and Federal agencies to ensure we were requesting an amount of water that would not cause negative impacts to the surrounding businesses and communities. We also hired a separate hydrogeology firm to review and audit LBG's findings. Based on the data, these experts determined that every day about 200 million gallons of water flow through the aquifer and into the ocean, far more than the roughly 8.3 million gallons currently being withdrawn daily by dozens of companies, utilities, golf courses, and residential communities. We have asked for access to 1.5 million gallons per day. The experts' studies indicate that the aquifer is dependable and that our proposed usage wouldn't harm or deplete it. Even with our proposed usage, 95% of the aquifer's daily flow, or more than 190 million gallons, would seep from the aquifer into the Atlantic Ocean, unused, every day.

Furthermore, any groundwater we would withdraw from the aquifer would be subject to significant restrictions and monitoring according to the Trident Area Capacity Use Groundwater Management Plan that was developed by the state's Department of Health and Environmental Control (DHEC). This plan, designed to protect the environment and residents of South Carolina, was unanimously approved by the Berkeley-Dorchester-Charleston Council of Governments and the DHEC board. We will comply with all of the requirements of this plan and DHEC's existing groundwater regulations, including the ongoing local monitoring of the aquifer.

Additionally, we will continue to use the water at Berkeley County responsibly. Our data centers are designed for efficiency, including how we use water. In addition to having a rainwater retention pond on site to help us offset our water use at Berkeley County, we recycle water over and over through our cooling system, until nearly all of it has been used for evaporative cooling. Imagine doing your dishes, then using the same water to do your laundry, then using it again to take a shower, to wash your car, to water your lawn, to wash your dog, and then using the same water all again the next day until nothing was left without sending it down the drain.

Above all, we're your neighbors and active members of the community. We have long cared about the Low country, and want the economy to be robust and our environment and waterways to be healthy. We're confident that our proposal achieves both, and we look forward to growing here for years to come.

III. GROUNDWATER PERMIT REQUEST

The project, as described in the Permit Application, is for the purposes of providing a source of cooling water for an expansion of the Maguro facility located in Berkeley County. The request is to increase the existing groundwater usage permit from 0.5 MGD to 1.5 MGD. This source needs to be readily available, consistent, reliable, and sustainable to meet Maguro's strict availability commitment to their customers and services. If any of these criteria are not met, expansion at Berkeley County cannot happen.

On May 11, 2017, the Initial Groundwater Management Plan for the Trident Capacity Use Area was adopted (the "Plan") by the Board of Health and Environmental Control. Importantly, the Plan identifies categories of groundwater withdrawal to include "Industrial process (IN) - Water used for commercial and industrial purposes, including fabrication, processing washing, and in-plant conveyance and cooling."

The Plan highlights five groundwater management strategies which are addressed in this report to show conformance of this request.

Strategy 1: Identify areas where a leveling and/or reduction in pumping is appropriate

In implementing this strategy, DHEC considers the best available geologic and hydrogeologic characteristics of the aquifer in order to determine if applicants or existing permittees need to reduce pumping. To facilitate DHEC's review, Maguro's consultants who are licensed hydrogeologists from LBG have prepared a report which is included in this submittal under Appendix II - "Hydrogeologic Report for Support of a Groundwater Withdrawal Permit Application For 1.5 MGD for Well TW-1 Moncks Corner, South Carolina." This report, which was further reviewed by a reputable third-party engineering and hydrogeology firm with a thorough knowledge of regional and local conditions, is provided for DHEC's use as a supplement to their own modeling efforts, at their discretion.

Maguro's consultants conducted an aquifer (or "pumping") test to aid in predicting impact to surrounding groundwater users within and outside the proposed aquifer and to better define the characteristics of the aquifer. Maguro and our consultants utilized the publicly available USGS groundwater flow model "Regional Aquifer

System Analysis" and site-specific aquifer test results to predict water level change, or draw-down, in the aquifer resulting from Maguro's proposed permit application. The groundwater flow model indicated no adverse impacts on the production capability of surrounding wells. In addition, the pumping test results demonstrated that the McQueen Branch/Middendorf aquifer (including the Charleston sub-unit receives adequate natural recharge sufficient to support the proposed withdrawal.

Based on the best available tools and data, Maguro has demonstrated, consistent with this strategy, that the aquifer can support the on-site pumping associated with the permit application without the necessity of future reductions in pumpage from the applicant and other users.

Strategy 2: Review of permit applications based on demonstrated reasonable use

The Plan identifies development of a "Water Use Plan" or "Best Management Strategy" to address reasonable use and to include an explanation of all conservation techniques. As it relates to water conservation techniques, Maguro's submittal includes a description of its ion exchange water treatment system that allows for water reuse continuously through the cooling process allowing for nearly 100% water use efficiency and nearly zero waste. Maguro describes their water supply strategy as a strategy of redundancy with diversified sources - primarily potable water and groundwater, supplemented with stormwater when available.

Strategy 3: Establish a comprehensive groundwater monitoring program

The plan includes information identified as being necessary to address gaps in monitoring data for the McQueen Branch/Middendorf aquifer. It discusses appropriate monitoring network installations and suggests locations of new monitoring wells to address these gaps. In addition to the continuous monitoring that Maguro will perform at Well TW-1, as a condition of, or as mitigation for, a permit authorizing withdrawal of 1.5 MGD, Maguro agrees to fund the establishment of additional monitoring wells for the McQueen Branch in northern Berkeley County - a need identified in the Plan for implementation of Strategy 3.

Strategy 4: Establish a conservation educational plan for the general public and existing groundwater withdrawal users

DHEC seeks a conservation educational plan for the general public and existing groundwater withdrawal users. Maguro has a proven track record as being stewards of the environment and education across the globe, including here in South Carolina. DHEC has the full support of Maguro in developing a new educational plan and we are willing and able to support the initiatives to the best of our ability as we have repeatedly done in the past.

Strategy 5: Regulation and planning

To implement this strategy DHEC seeks to utilize groundwater monitoring data and the predictive groundwater flow model currently being developed by USGS and SCDNR to influence regulatory review and planning efforts. Maguro's permit application is consistent with this strategy through Maguro's efforts to expand the monitoring well system in Berkeley County and provide site-specific hydrogeologic data resulting from its on-site aquifer testing and modeling efforts.

APPENDIX I - WATER SUPPLY ALTERNATIVES ANALYSIS

FOX Engineering Associates, Inc.

I. INTRODUCTION

This appendix to the Report addresses: the potential expansion of infrastructure and operations at Maguro's data center in Berkeley County, South Carolina, the water sources presently used by Maguro for process cooling water, and the alternatives identified and considered for process cooling water supply for the expansion.

II. COOLING WATER SUPPLY STRATEGY

The primary sources of cooling water currently supplying the data center are potable water from the local municipal treatment facility and stormwater collected on-site. Maguro's demand for cooling water at Berkeley County increases significantly with the potential expansion of the data center. There are limitations on the availability of potable water and stormwater, described below, that necessitate the identification and evaluation of other water sources to serve the expansion.

Section III below summarizes the various options identified and evaluated as alternative sources of water to supply the expansion of the data center. A new alternate water source is needed to supplement the use of the existing water sources. As diverse water source(s) become available, it is in Maguro's best interest to utilize each source, existing and new, for redundancy, and to avoid putting undue stress on any single source.

III. PROJECT PURPOSE AND ALTERNATIVES

Maguro submitted a permit application seeking authorization to increase the permitted withdrawal of groundwater at the Berkeley County data center from 0.5 MGD (Million Gallons per Day) to 1.5 MGD. As described in the Permit Application, this additional groundwater would provide a source of cooling water to a potential expansion of the facility. This source needs to be readily available, consistent, reliable, and sustainable to meet Maguro's strict availability commitment to their customers and services.

The Berkeley County data center houses the infrastructure used to provide global services, but only at the capacity it can reliably sustain given its resources (water is currently the limiting resource). These services are extensive and include Google Search, Maps, Drive, Docs, Play, Calendar, Photos, G-Mail, Google Cloud, and YouTube, just to name a few. Although this data center is a regional facility, it processes a significant portion of Maguro's Global Operations and Services. To expand further in Berkeley County, Maguro must ensure that all of the necessary resources, including water, are available. Maguro currently has several other sites within the region, including: Georgia, Tennessee, North Carolina and Alabama.

Data center expansion represents a significant capital investment. The new construction and ongoing operations cost associated with this size of expansion constitute hundreds of millions, potentially billions, of dollars of investment. Maguro's decision to commit to expansion in any region or site is dependent upon the confidence that the necessary resources, including cooling water, are available. If this resource is not available, Maguro will not be able to continue further development and expansion necessary to provide reliable service to customers at that location.

The identified water source must satisfy the following criteria:

Screening Criteria and Explanation:

- Available - Water source must be available in advance of expansion at the required capacity for that build-out.
- Consistent - Water source capacity must be consistently available to meet the capacity requirements at any given time and not be limited by peak flow demands or seasonal fluctuations.
- Reliable - Water source and infrastructure must be in place to minimize downtime in the event of a failure condition.
- Sustainable - Water source must be capable of providing necessary flow to support long term planning for the data center.

Water Sources:

The following water source alternatives were evaluated.

Potable Water
PW1. Potable Water Supply

Surface Water
SW1. Surface Water Supply from Lake Moultrie SW2. Surface Water Supply from Durham Canal

Stormwater
ST1. Stormwater Pond Supply

Greywater
GW1,2. Greywater Supply from Lower Berkeley WWTP GW3,4. Greywater Supply from Central Berkeley WWTP

Groundwater
GW. Groundwater Supply with Various Treatment Options

IV. APPLICATION OF SCREENING CRITERIA TO IDENTIFY AND EVALUATE ALTERNATIVES

No Action Alternative (limit withdrawal to existing 0.5 MGD authorization.)

The No Action Alternative is inconsistent with Maguro's plans for growth and expansion of the Berkeley County data center. Expansion of the data center is dependent on the availability of sources of water for cooling the data center. If Maguro were to adopt the No Action Alternative, and abandon its request for authorization to increase its withdrawal from .5 MGD to 1.5 MGD, then all resources dedicated to expansion of the Berkeley County data center will be withdrawn and diverted to other locations outside of South Carolina.

No Action is not a feasible alternative for implementation of the plans to expand the Berkeley County data center. The expansion plans include the construction of multiple large scale buildings to house the technology and equipment necessary to support Google Services, which triggers a need for additional water supply. Water plays a critical role in the sustainable operations of the facility, keeping the energy usage low. Without water based cooling, it is not the most sustainable option and does not make economic sense to operate and expand in Berkeley County. In the absence of a consistent, reliable, sustainable, and available water source to cool the expansion under high temperature and high demand conditions, the expansion fails.

Increase in Potable Water Consumption

In aggregate, Maguro and Berkeley County Water & Sanitation (BCWS) have been working for about 5 years to develop a sustainable potable water supply plan to service Maguro's target growth in Berkeley County. This alternative consists of treated surface water from Lake Moultrie via Santee-Cooper or a connection to Charleston Water System (CWS), which Maguro purchases from BCWS. Consistent with Maguro's internal water use plan -- to prioritize potable water supplies ahead of groundwater -- this resource will continue to be the site's primary water resource. However, the existing transmission main serving Maguro is at maximum capacity, and an increase in capacity requires a new main routed in a new pathway (requiring new easement acquisition and/or right-of-way use).

As explained in the following paragraphs, we have faced significant challenges and delays delivering a viable solution to increase potable water supply to Maguro's site from BCWS. As we stand today, any potential potable supply upgrades will not come fast enough to support Maguro's recently proposed $600 million expansion.

As part of these historical efforts to expand potable supply, a new 3-mile-long transmission main connecting to the BCWS system was initially designed in 2014 at 100% Maguro's expense. This main was intended to provide the capacity needed for the expansion, and also to benefit BCWS and its constituents. Since 2014, Maguro has designed three different routes for this transmission line and encountered impediments to obtaining necessary site control with each. In 2015, a new BCWS water tower was designed and constructed (also at 100% Maguro expense) directly adjacent to the data center campus along Highway 52, anticipating the increase in capacity BCWS committed to provide to Maguro. Like the transmission main, this tower will ultimately provide operational benefits to the BCWS system. This tower remains empty today due to BCWS capacity constraints.

Given the impediments encountered in the transmission line work detailed above, which amounted to several years and millions of dollars spent, this 3-mile transmission main project was ultimately abandoned. Maguro then began working with BCWS in 2017 to develop an alternate line supplying water from the CWS connection (the 'CWS line'). This BCWS-led project requires an estimated 2 years to complete and will bring potable water capacity increases for both Maguro and the BCWS system. Other benefits to BCWS will include improved pressure regulation and filling the water tower Maguro constructed along Highway 52. In support of this project, Maguro has signed a reservation agreement with BCWS that will become active upon the project's completion.

The CWS line project is now significantly delayed from its original scheduled completion date due to slow progress obtaining the necessary easements. Because of delays to the CWS line, Maguro now faces a near-term shortfall on guaranteed water supply to support operational needs for the growing data center campus. This shortfall poses a threat to both current and future expansion plans, as Maguro requires water resources to guarantee they can provide reliable service to customers of their data center services.

Maguro continues to support the delivery of the CWS line with BCWS, and will seek to use this potable water supply as their primary resource once the project is completed. However, this expected increase in potable water consumption does not currently satisfy all of the screening criteria. The water is not readily available today and has no certain or guaranteed date of availability. With no confirmed solution for this source, the required consistency, reliability, and sustainability of this option is unknown and presently considered non-existent. Additional potable water, once it is available in the required capacity, is likely to be consistent and sustainable. However, Maguro cannot move forward with the Berkeley County data center expansion without a readily available source of cooling water in place.

Surface Water

The potential to supply cooling water from existing lakes and rivers was evaluated. The evaluation examined several project considerations including: regulatory and permitting requirements from DHEC, the Federal Energy Regulatory Commission (FERC) and the US Army Corps of Engineers (USACE), construction feasibility, schedule, ongoing operations, and costs associated with intake and transmission infrastructure. Due to many uncertainties, distances, and complexities, the schedule of this alternative is even greater than that of increased potable supply and therefore is not considered for this expansion.

The two potential intake locations explored for this study include the south end of Lake Moultrie, which is 12 miles north of the Maguro site and the Durham Canal, which is 5 miles to the east. Both sources have adequate supply potential and similar water quality.

While withdrawal from the Durham Canal is more viable than from Lake Moultrie due to distance, surface water withdrawal is still not readily available. If surface water were available, it would likely be consistent, reliable, and sustainable.

However, the delay associated with obtaining the necessary approvals for construction and installation of 5 miles of transmission line render this alternative infeasible and no more attractive than a potential future expansion of potable water supply, when available.

Stormwater

The potential for reuse of stormwater from onsite stormwater detention ponds as a source of cooling water supply was evaluated. The existing site currently has three stormwater ponds with potential for stormwater harvesting, one of which is currently harvested. If the existing stormwater treatment system is expanded and the second pond is deepened for usability, it is estimated that approximately 59% of the site's stormwater (or 116 MG per year) could be reused for cooling water supply. This equates to roughly 0.32 MGD cooling capacity on average equated to a year-round basis, which is only a small portion of total water needs. The third pond is not suitable for stormwater harvesting as it is too low for stormwater storage. Although stormwater will continue to be utilized as a water efficiency resource, it is not available, consistent, reliable, or sustainable in the necessary quantities as a water source to satisfy the need for further facility expansion. It is also not available during temporary drought or irregular rainfall periods as the stormwater is not replenished. Maguro is committed to continued use of stormwater to supplement its water needs, but stormwater is not available to address the water demands associated with expansions.

Greywater

A thorough review was conducted of potential greywater sources near the data center site. A listing of current National Pollutant Discharge Elimination System (NPDES) permits obtained from the Department of Health and

Environmental Control (DHEC) was used to identify facilities discharging greywater into nearby rivers or streams. From this list, a total of 11 dischargers were identified as being potentially viable suppliers of greywater. This list of 11 dischargers was then further evaluated and narrowed down to only 2 potentially viable sources due to volume of water available and potential water quality for reuse.

The two greywater sources that had the highest potential for reuse as cooling water were the Lower Berkeley Wastewater Treatment Plant and the Central Berkeley Wastewater Treatment Plant. Both of these facilities are owned and operated by the Berkeley County Water and Sanitation (BCWS) district.

The Central Berkeley WWTP is located 5.5 miles from the site. Although it is the closest plant to the data center, it has insufficient volume to address the water demands of the expansion with only an average flow rate of less than 0.5 MGD. The plant's reliable minimum flow rate is also insufficient.

The Lower Berkley WWTP is located 10.9 miles from the data center site. Due to the overall distance from the data center, greywater from this plant is not readily available to the data center. For purposes of long-term planning, the use of greywater from Lower Berkeley WWTP to supplement Maguro's water needs may be feasible, but it would be several years before the long transmission pipe and upgrades to the WWTP could be permitted and installed. In addition, the transmission of treated effluent from the Lower Berkeley WWTP to the data center relies on the existence of long-term enforceable agreements between a private entity (Maguro) and a public entity which currently do not exist. The average flow rate from this source is between 8.0 and 10.0 MGD making this source an attractive source from a capacity standpoint for future considerations. In long term-planning, consideration could be given to developing a shared water resource from this WWTP with other industrial water users along the industrial corridor. However, this type of cooperative arrangement often takes several years to work out the legal framework before the infrastructure improvements begin.

Groundwater

The potential for cooling water supply from local groundwater sources was evaluated. The evaluation revealed five aquifers present in Berkeley County in the Atlantic Coastal Plain Aquifer System including: the Surficial aquifer, the Floridan/Tertiary Sand aquifer, the Black Creek aquifer, the Middendorf aquifer, and the Cape Fear aquifer. Only the Black Creek/Middendorf and the

Floridan/Tertiary Sand aquifers have the potential for sufficient yields with reasonable water quality. However, the South Carolina Department of Health and Environmental Control (SCDHEC) indicated that the Floridan aquifer was not a favored option because of multiple private residential supply wells located near the data center, leaving only the Black Creek/Middendorf aquifer as a suitable source. Refer to Appendix II - Hydrogeologic Report for Support of a Groundwater Withdrawal Permit Application for 1.5 MGD for Well TW-1 Monks Corner, South Carolina for the detailed evaluation of the proposed groundwater supply.

Groundwater extracted from the Black Creek/Middendorf aquifer is readily available, reliable, and sustainable with consistent flow potential without negatively affecting the aquifer or other users as demonstrated by the pump test and analysis. Therefore, groundwater from this aquifer satisfies all screening criteria.

IV. SELECTION OF GROUNDWATER

Potable water is currently the primary source for Maguro's Berkeley County data center site. An increase in potable water supply is not available to meet the schedule of the expansion at the required capacity. At a minimum, at a very aggressive schedule with no contingency, it will take several years to complete the contract negotiations between multiple utility providers, design and review of infrastructure, State and Federal permitting, multiple easement acquisitions, construction and commissioning of a new several mile-long utility line, and a new pump station. Potable water remains a top candidate for future water source upgrades, but is not available for this expansion.

A surface water withdrawal, assuming that Maguro obtained authorization for such withdrawal from DHEC and other agencies, would require transmission lines extending, at a minimum, five miles, and possibly as far as 12 miles. Either distance, this is a significant installation of infrastructure through public and private property and environmentally sensitive areas. The timing of completion of such installation is uncertain based on the approvals required. This alternative is not readily available or reliable, does not support the construction schedule, and would not support a commitment of resources for expansion of the data center.

Additional stormwater and greywater from Central Berkeley were quickly eliminated as feasible alternatives based on the amount of water required.

Utilization of treated wastewater effluent from Lower Berkeley's WWTP may be, in the long-term, a viable supplemental water source. However, it requires the installation of 11 miles of transmission lines through public and private property and environmentally sensitive areas. It would take several years to complete the design, permitting and construction necessary to implement this alternative and requires establishment of a long-term arrangement with BCWS. This alternative is not readily available or reliable, does not support the construction schedule, and would not support a commitment of resources for expansion of the data center.

Alternate Source vs. Screening Criteria				
Source	Available	Consistent	Reliable	Sustainable
Potable		X	X	X
Groundwater	X	X	X	X
Stormwater				X
Greywater				X

Table 1: All four screening criteria need to be met for a source to be considered viable for the potential expansion of the data center. Groundwater is the only source that meets all screening criteria.

As shown in this Water Supply Alternatives Analysis and as summarized in Table 1, The only alternative that supports the construction schedule and allows Maguro to commit the resources to proceed with expansion at Berkeley County is groundwater. Groundwater is readily available to support the expansion. Groundwater is a reliable and consistent source of cooling water as all necessary infrastructure is located at the data center site. It is also sustainable within sufficient quantities to cool the data center for years to come into the future without negatively impacting other groundwater users or the aquifer.

The operational cost of water, from any source, is a relatively small percentage of the overall operational cost of the Maguro facility and is not considered the primary decision driver. However, reliability and availability is. New facilities and onsite infrastructure are required for this groundwater system and features such as redundancy, storage, water treatment, security, monitoring and controls make this a relatively costly option. Development of the on-site groundwater source to date, which includes the costs related to the construction, testing, and permitting of Well TW-1 are more than $20 million. Contrary to public opinion, groundwater is not "free", and Maguro's decision to utilize the local groundwater resources of the McQueen Branch aquifer is not based on economics.

To minimize the quantity of water needed for non-contact cooling at the Site, Maguro has invested an additional $2 million to install a new ion exchange water treatment system that substantially reduces waste. With this new treatment system, nearly 100% of the groundwater consumed will be used for cooling purposes for maximum efficiency.

After identifying and evaluating numerous potential sources of cooling water, Maguro has reached the clear conclusion that groundwater is the only source which meets the needs of the proposed expansion, and which enables Maguro to continue to add significant jobs and investment at the Berkeley County data center.

APPENDIX II

HYDROGEOLOGIC REPORT FOR SUPPORT OF A GROUNDWATER WITHDRAWAL PERMIT APPLICATION FOR 1.5 MGD FOR WELL TW-1 MONCKS CORNER, SOUTH CAROLINA

Prepared for:

FOX ENGINEERING ASSOCIATES, INC.
and
MAGURO ENTERPRISES, LLC

September 2017

Prepared by:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Services
600 East Crescent Avenue, Suite 200
Upper Saddle River, NJ 07458

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INTRODUCTION

The groundwater consulting firm of Leggette, Brashears & Graham, Inc. (LBG) has completed in conjunction with FOX Engineering Associates, Inc. (FOX), and on behalf of Maguro Enterprises, LLC. (Maguro), a hydrogeologic evaluation in support of a Groundwater Withdrawal Permit application for a recently installed supply well identified as Test Well TW-1 (Well TW-1) located at the Maguro property on the west side of Route 52 in Moncks Corner, Berkeley County (the Site). This corresponding summary of the hydrogeologic evaluation also includes information to address the applicable goals of the South Carolina Department of Health and Environmental Control Board (SCDHEC) of the recently adopted Groundwater Management Plan for the Trident Capacity Use Area (Trident Area). Information is also included on studies conducted evaluating several other water supply sources.

Purpose

The purpose of the hydrogeologic evaluation was to determine the feasibility of utilizing Well TW-1 as a future source of non-contact cooling water for the Maguro facility. The evaluation focused on the long-term yield of Well TW-1 and that of the tapped McQueen Branch (aka Middendorf aquifer as was commonly used by the USGS prior to 1995) aquifer, and the potential for impacts on nearby groundwater resources and known water supplies. The evaluation efforts included: the installation of a large-diameter "test" well, designed and constructed in a manner to enable future use as a supply well (TW-1), and two small diameter observation wells; completion of a 72-hour constant rate pumping test of Well TW-1; and use of published regional and site-specific aquifer characteristics to develop a numerical model for projecting pumping impacts reflective of the anticipated groundwater supply demands from Well TW-1.

This report has been prepared in support of a corresponding application for a SCDHEC Groundwater Withdrawal Permit for the currently proposed pumping of groundwater at the Site. As of November 16, 2015, Maguro has received approval from SCDHEC to withdraw 15.5 million gallons per month (MGM), or an average of 0.5 million gallons per day (MGD), from Well TW-1. Subsequent to receipt of this approval, Maguro had revised its proposed groundwater withdrawal projections for the current respective application to 46.5 MGM, and 549 million gallons per year (MGY), which is equivalent to a daily average, over the course of a year, of approximately 1.5 million MGD. Throughout the year, cooling-water demand projections by Maguro indicate that pumping of Well TW-1 will vary seasonally.

Background

Previous reviews of available information regarding local and regional hydrogeology resulted in the selection of the regionally extensive and deep (locally occurring in excess of 1,300 feet below grade) Crouch Branch and underlying McQueen Branch aquifers (aka Black Creek and Middendorf aquifers, respectively) as possible sources of groundwater supply for the Site. The tentative selection of these two aquifers for development of an on-site supply well was primarily based on the reported high-yield capacity (i.e., potential yield in excess of 2 to 3 MGD from a single well) of these aquifers, low potential for interference with nearby private potable supply wells which reportedly typically tap the significantly shallower Floridan aquifer (Figure 1), and ability of the aquifers to sustainably support the proposed withdrawal rates through natural recharge, as discussed below.

The targeted aquifers correspond to the Late Cretaceous formations that occupy the geologically older and deeper portions of the Coastal Plain aquifer system underlying the eastern region of South Carolina. These aquifers were selected not only because of their relatively high yield potential, but because the corresponding primary recharge areas were anticipated to correspond with their respective outcrop area located tens of miles west of the site and proximal to the "Fall Line." In addition, the relatively recent discontinuation (starting circa 1995) of use of the Crouch Branch and McQueen Branch aquifers as water supplies for the City of Charleston, Jamestown, and St. Stephen, as well as the Berkeley County Water and Sanitation Authority (BCWSA), has resulted in an overall significant decrease in demand on these local groundwater resources making them even more attractive as a possible supply source for the Maguro facility.

EXPLORATION AND TEST WELL CONSTRUCTION PROGRAM

In the fall of 2014, an on-site groundwater exploration/development program commenced with the installation of Well TW-1 and two observation wells (MW-1 and MW-2). Based on the encountered local hydrogeologic conditions, all three wells were completed in the McQueen Branch aquifer. All of the wells were completed by December 2014 (Table 1). The completed test and observation wells were subsequently used for completion of a long-term (72-hour duration) aquifer test in January 2015.

Summary of Observation Well Installation and Construction

Monitor (observation) Wells MW-1 and MW-2 were installed by Layne in October 2014, using the mud-rotary drilling method (Figure 2). The drilling began at MW-1, located at the northeast corner of the Site, followed by MW-2 located at the southeast corner of the Site. Penetrated geologic materials were continuously collected throughout the entire borehole advancement process. The geologic logs for the respective borings, corresponding well construction information, and downhole geophysical logs are provided as Attachment I.

The Monitor Well MW-1 borehole was advanced as a 10-inch diameter boring drilled to a total depth of 1,725 feet below grade (ft bg). Below the locally occurring water-table ("shallow") aquifer, the Floridan aquifer (typically consisting of two to three distinct aquifer units) was encountered between the depths of 190 and 500 ft bg. The comprising material consisted of fine sand, limestone, and shell fragments. Below the Floridan aquifer, the borehole penetrated a confining unit consisting of mostly silt with some fine sand and clay that extended from about 500 ft bg to a depth of approximately 1,130 ft bg. The Crouch Branch aquifer was penetrated below the approximately 600 feet thick confining unit and extended to a depth of approximately 1,300 ft bg. The Crouch Branch aquifer was underlain by a confining unit composed of silt and clay, that extended to a depth of approximately 1,570 ft bg. The base of this confining unit transitioned from silt to medium sand which marked the top of the McQueen Branch aquifer that extended to a depth of 1,665 ft bg. The borehole penetrated the entire thickness of the McQueen Branch aquifer and into the underlying confining unit of silt and clay corresponding to the end of the boring.

Monitor Well MW-1 was constructed with a 10-inch diameter surface casing extending from about two feet above grade to 200 ft bg, and a 4-inch diameter inner casing and screen assembly set at a completion depth of 1,645 ft bg. Based on sieve analyses results for wash samples collected during borehole drilling and the corresponding geophysical log, Monitor Well MW-1 was constructed with a 4-inch diameter, 20-slot (0.020-inch opening), stainless steel, continuous wire-wrapped screen set from 1,605 feet to 1,645 ft bg. The screen is surrounded by "#1" gravel pack material purchased from Southern Products & Silica Company, Inc., and extending from 1,555 to 1,646 ft bg. A grout seal was placed extending from grade to 1,555 ft bg. The static water level measured at Monitor Well MW-1 at the time of completion was about 51 ft bg.

The Monitor Well MW-2 borehole was advanced as a 10-inch diameter boring drilled to a total depth of 1,738 ft bg. The Floridan aquifer was encountered between the approximate depths of 230 and 330 ft bg. The comprising material encountered consisted of fine sand, limestone, and shell fragments. The confining unit underlying the Floridan aquifer consisted mostly of silt and clay that extended to a depth of approximately 1,200 ft bg. A few thin layers of predominantly sand were encountered between 800 and 900 ft bg in this confining unit. Alternating layers of silt and sand extending from below the confining unit to a depth of approximately 1,400 ft bg comprised the underlying Crouch Branch aquifer. The Crouch Branch aquifer was in turn underlain by a confining unit composed of silt and clay, extending to a depth of approximately 1,530 ft bg. A fine sand and silt unit observed to a depth of about 1,580 ft bg marked the transition to the McQueen Branch aquifer which consisted primarily of medium sand extending to a depth of 1,700 ft bg. At the Monitor Well MW-2 location, the McQueen Branch aquifer was observed to be underlain by a confining unit of silt and clay that extended to the completion depth of the borehole. A sand unit was encountered within this confining unit between about 1,710 and 1,730 ft bg.

Monitor Well MW-2 was constructed with a 10-inch diameter surface casing extending from grade to 200 ft bg, and a 4-inch diameter inner casing and connected screen extending from about 3 feet above grade to a completion depth of 1,645 ft bg. Based on sieve analyses results for wash samples collected during borehole drilling and the geophysical log for the completed borehole, the 4-inch diameter, 20-slot, stainless steel, continuous wire-wrapped screen was set from 1,615 ft bg to 1,645 ft bg. The screen is surrounded by a "#1" gravel pack provided by Southern Products & Silica Company, Inc., and extending from 1,565 ft bg to 1,647 ft bg. A grout seal was installed extending from grade to the top of the gravel pack at 1,565 ft bg. The static water level measured at the time of completion at Monitor Well MW-2 was about 54 ft bg.

Summary of Test Well Installation and Construction

A large-diameter 'test' well (TW-1) was installed by Layne between October and November 2014, using mud-rotary drilling methods (Figure 2). The well borehole was advanced to a depth of 1,707 ft bg. Penetrated materials were continuously collected throughout the entire borehole drilling process. The Floridan aquifer was encountered between a depth of 180 ft bg, and approximately 500 ft bg. Below the Floridan aquifer, a confining unit consisting of alternating fine sand and silt layers with traces of clay extended to a depth of about 1,180 ft bg. The Crouch Branch aquifer consisting primarily of medium to coarse sand was penetrated from about 1,180 ft bg to about 1,415 ft bg. A confining unit consisting primarily of silt and fine sand with clay lenses was encountered beneath the Crouch Branch aquifer and extended to a depth of approximately 1,570 ft bg. The McQueen Branch aquifer, consisting of medium sized sand and shell fragments was encountered beneath the confining unit, and extended from 1,570 ft bg to 1,685 ft bg. The McQueen Branch aquifer was underlain by a confining unit of silt and clay that extended to the borehole completion depth. Based on the encountered hydrogeologic conditions, Well TW-1 was completed in the McQueen Branch aquifer.

Well TW-1 was constructed with a 20-inch diameter surface casing, and a 14-inch diameter inner casing and screen set at a completion depth of 1,682 ft bg. Based on sieve analyses results for wash samples collected during borehole drilling and a corresponding downhole geophysical log, a 14-inch diameter, 40-slot, stainless steel, continuous wire-wrapped screen assembly was selected and set in the well. The installed screen assembly consists of 60 feet of stainless steel riser pipe extending from 1,522 ft bg to 1,582 ft bg, followed by 15 feet of screen section extending from 1,582 ft bg to 1,597 ft bg, followed by 15 feet of stainless steel blank, and lastly followed by 70-feet of screen extending from 1,612 ft bg to 1,682 ft bg. The screen is surrounded by a "#2" gravel pack provided by Southern Products & Silica Company, Inc., and extending from 1,530 to 1,685 ft bg. A grout seal extends from grade to 1,570 ft bg. The static water level measured at the time of completion of Well TW-1 was about 40.6 ft bg. The geologic logs for this well and the two monitor wells are included in Appendix A.

Site Hydrogeology

The Site occurs in the Atlantic Coastal Plain (ACP) geologic province of South Carolina. This province covers an area of about 22,500 square miles in South Carolina, or approximately 70% of the state's total area. The geologic formations comprising the ACP form a generally seaward-dipping wedge of alternating layers and units of unconsolidated sand, silt, clay, and carbonate (limestone and shell layer) units, which overlie a crystalline bedrock foundation. The unconsolidated geologic deposits of the ACP extend from the "Fall Line" in western South Carolina, to the continental shelf along the eastern edge of the Atlantic Ocean. A cross-sectional schematic of the geologic formations comprising the ACP relative to the Site location is presented as Figure 1. The variations in depositional environments associated with the formations comprising the ACP, resulted in layers that inherently vary in thickness and lateral extent. In addition, the regional bedrock uplift known as the Cape Fear Arch resulted in erosion of some of the comprising ACP units, particularly in the outer Coastal Plain area (eastern part of South Carolina and the coast).

Based on samples collected from the borings completed at the site, the Floridan, Crouch Branch and McQueen Branch aquifers underlie the area. The McQueen Branch aquifer materials penetrated by Well TW-1 locally consist of approximately 100 feet of primarily medium sand starting at a depth of approximately 1,580 ft bg. The encountered aquifer materials are confined by an overlying unit of silt and clay, and an underlying confining unit consisting of a dense mixture of clay and sand. Bedrock was not reached at any of the drilled locations.

PUMPING TEST PROGRAM

Following completion of Well TW-1, a pumping test program (step-rate and constant-rate, long-term pumping tests) was implemented to establish the performance and long-term capacity of the well, and the impacts on the tapped aquifer resulting from the proposed pumping. The long-term, constant-rate test was conducted in accordance with standard hydrogeologic protocols developed by LBG specifically for Well TW-1. The respective step-rate and constant-rate pumping tests were conducted utilizing a temporarily-installed pump provided and installed by Layne. The pump used for the tests was a 3-Stage Verti-Line 16FHM vertical turbine rated for 2,500 gallons per minute (gpm) at about 300 feet of total dynamic head (TDH). This pump was set in Well TW-1 at a depth of 340 ft bg, and powered by a portable diesel-fueled generator. Water-level and pumping-rate data associated with the respective tests were collected by LBG and Layne personnel.

Step-Rate Pumping Tests

A short-term, step-rate pumping test of Well TW-1 was completed to assess initial performance (and related efficiency), and to provide a preliminary assessment of the local aquifer response to pumping to select an appropriate pumping rate for the subsequent long-term test. The step-rate test, conducted on January 13, 2015, involved the pumping of Well TW-1 at successively increasing rates ("steps") of 1,725 gpm, 2,023 gpm, and 2,611 gpm, respectively (Figure 3). The final drawdown corresponding to the 2,611-gpm step was 144.45 feet. The respective specific capacity (ratio of pumping rate to drawdown) corresponding to this rate was calculated at 18 gallons per minute per foot of drawdown (gpm/ft). Based on the water-level response and remaining pump pressure exhibited during the final 2,611-gpm step, a conservative pumping rate of 2,514 gpm was selected for use during the subsequent long-term constant-rate test.

Long-Term (72-Hour) Constant Rate Pumping Test

The long-term (72-hour duration) constant-rate pumping test of Well TW-1 was conducted between January 15 and 18, 2015. The test consisted of pumping Well TW-1 at a constant rate of 2,514 gpm for the first 10 hours of the test and then 2,388 gpm for the remainder of the 72-hour period resulting in a weighted overage pumping rate of 2,406 gpm for the test period. The rate was adjusted after the initial 10 hours of pumping to provide adequate back pressure for the pump to maintain a constant pumping rate throughout the remainder of the test. The pumped water was directed through 12-inch piping to a location approximately 2,500 feet southwest of the wellhead (Figure 2). The pumping rate was measured during the test using a 12-inch by 10-inch circular orifice weir, connected to the end of the discharge pipe.

The water levels were measured and recorded at Well TW-1 and three "observation" wells (MW-1, MW-2, and an off-site supply well located at the Santee Redi Mix Site). The respective water-level and pumping rate data were manually collected during the test by LBG and Layne personnel, and automatically measured and recorded with dedicated pressure-transducer datalogger units (i.e., In-Situ Level Troll) at Wells TW-1, MW-1, and MW-2. An additional In-Situ Level Troll was set at the piezometer tube for the orifice weir to measure and record readings corresponding to orifice flow rate throughout the duration of the test.

The generator used to supply power to the pump malfunctioned at approximately 7:00 a.m. on January 17, 2015. In response, Layne personnel immediately commenced working to return the generator to service which they succeeded in doing at 8:25 a.m. To account for the approximately 90 minutes of pump downtime, the test was extended by 120 minutes.

Besides the pumping period, water-levels were also measured and recorded for Well TW-1 and the observation points during the background (pre-pumping) and recovery (post-pumping) periods, respectively. The pre-pumping groundwater levels collected from the respective observation points generally exhibited a naturally-occurring (antecedent) rising water-level trend which continued to occur through the recovery period. The total projected rise in water level over the course of the nominal 72-hour pumping period was about 0.1 feet.

A rain gauge was set up at the Site to monitor any precipitation events which occurred during the test period, and a BaroTroll was used to collect barometric pressure at the Site throughout the background, pumping, and recovery periods of the test. The on-site meteorological data was supplemented with data collected and recorded by the National Weather Service for a station at nearby Berkeley County Airport (KMKS) in Moncks Corner. The corresponding meteorological data indicate that 1.08 inches of rainfall fell during the background period (January 12), and 0.44 inches of rainfall fell during the nominal 72-hour pumping period (early morning of January 18th).

The water discharged during the constant-rate test of Well TW-1 was sampled by Garratt-Callahan Company and LBG personnel throughout the duration of the nominal 72-hour pumping period and submitted for laboratory analyses to the Garratt-Callahan Company laboratory. LBG personnel collected discharge water samples from a dedicated faucet near the well head throughout the duration of the test. These samples were inspected for visual evidence of entrained air, color, and particles/sediment. In addition, LBG personnel analyzed these samples for pH, conductivity, temperature, turbidity, and redox potential using a Horiba multi-probe instrument and flow-through sampling cell, and Hach kits to measure total iron, hardness, and chloride concentrations throughout the test.

Hydrographs of the depth to water measured over time for Well TW-1 and the monitored observation wells are provided as Figures 4 through 7, respectively. Graphs of drawdown (difference between static water level and pumping level) versus elapsed time since pumping started (logarithmic scale) for Well TW-1 and the on-site observation wells, respectively, are provided as Figures 8 through 10. A graph of the distance (logarithmic scale) from Well TW-1 to the respective observation wells versus drawdown corresponding to the end of the nominal 72-hour pumping period is provided as Figure 11. Graphs of "time ratio" (ratio of elapsed time since pumping started to elapsed time since pump shutdown expressed on logarithmic scale) versus residual drawdown (recovery level relative to pre-test static water level) for Well TW-1 and on-site observation wells are provided as Figures 12 through 14, respectively.

ANALYSIS OF PUMPING TEST DATA

Summary of Step-Rate Tests

The water level data collected during the step-rate test of Well TW-1, converted to drawdown, were used to compare specific capacity values to respective pumping rates in order to assess the initial "performance" (reflection of efficiency) of the well. The drawdown calculations were normalized based on a 60-minute pumping duration per step, and with consideration to prior "step" data trends. The graph of pumping rate (respective "steps") versus the inverse of corresponding specific capacity values exhibits a trend ("slope") that indicates Well TW-1 is "properly designed and developed" (Walton, 1977[1]). Based on the results of this evaluation of the step-rate test data, it can be concluded that the initial efficiency of Well TW-1 was optimal relative to the tapped aquifer makeup prior to commencement of the 72-hour constant-rate pumping test.

Summary of Long-Term Constant Rate Pumping Test

The constant rate test of Well TW-1 was conducted over a 74-hour duration, with a decrease in pumping rate from 2,514 gpm to 2,388 gpm occurring approximately ten hours into the pumping period. Each of the respective hydrographs and elapsed time versus drawdown plots for the on-site wells, exhibit evidence of water-level responses to a short-term malfunction of the generator which occurred at approximately 7:00 a.m. on January 17, 2015. The water level at Well TW-1 continued to decline throughout the duration of the test to a final depth of about 225 feet below the top of casing (ft btoc) for an equivalent total

[1] Walton, W.C., 1977. Selected analytical methods for well and aquifer evaluation, Illinois State Water Survey Bulletin 49, Urbana, Illinois, 81p., 4th printing.

drawdown of about 171.5 feet by the end of the pumping period (Figures 4 and 8). Most of the drawdown occurred during the initial ten hours of pumping, with only about 17 feet occurring over the final 2.6 days of pumping at 2,388 gpm. An extension of the corresponding drawdown trend for an additional six months of pumping at the weighted average pumping rate of 2,406 gpm indicates that the projected final water level would be about 210 feet of drawdown, or 1,300 feet above the screen setting (Figure 8).

A measurable, though relatively insignificant compared to the aquifer degree of drawdown, interference was exhibited at both on-site observation wells in response to the pumping of Well TW-1 (Table 2). As previously mentioned, a naturally-occurring antecedent water-level rise of about 0.1 feet was exhibited at all of the on-site monitored locations throughout the pumping period. The total amounts of interference exhibited for the respective observation wells by the end of the pumping period were 30.2 feet at MW-1 (3,181 feet from TW-1) and 30.7 feet at MW-2 (3,246 feet from Well TW-1). Due to the distance between Well TW-1 and the on-site observation wells being more than twice the thickness of the locally tapped aquifer (i.e., greater than 200 feet), the drawdown data for Wells MW-1 and MW-2 did not need to be corrected for potential vertical flow loss influences due to the corresponding screens not being of adequate length to span the entirety of the aquifer thickness (i.e., partial penetration effects). The off-site supply well located at the Santee Redi Mix facility, which appears to be completed in the Floridan aquifer, did not exhibit any discernible interference due to the pumping of Well TW-1 (Figure 7).

The water-level recovery data for Well TW-1 and the respective observation wells substantiate the conclusion that the tapped aquifer can support the local pumping of Well TW-1 at a rate of at least 2,406 gpm (Figure 12 to 14). The corresponding time ratio (t/t') versus residual drawdown plots for the respective wells exhibit data trends indicative of relatively rapid recovery, reflective of an adequate groundwater recharge scenario relative to the pumping rate used during the test. Illustrative of this condition, is the attainment of the water level at Well TW-1 to reach 90% recovery after the pump had been shut off for approximately 14 hours.

Aquifer Characteristics

Water level data obtained during the constant-rate pumping test and converted to drawdown and residual drawdown, and plotted against elapsed time, time ratio, and distance, respectively, were used to determine the hydraulic characteristics of the unconsolidated sand deposits comprising the McQueen Branch aquifer tapped by Well TW-1. The calculated characteristics included transmissivity (measure of groundwater flow through the aquifer thickness) and storativity (reflective of the specific yield and groundwater "confinement" in the aquifer). The respective hydraulic characteristics were calculated using the "straight line" methods of Cooper-Jacob (1946[2]) and the corresponding data plots with an assumed constant pumping rate of 2,406 gpm (based on the weighted average of the rates recorded throughout the test). The utilized plots for selective wells [drawdown versus elapsed time; residual drawdown (recovery) versus elapsed time ratio (t/t'); and drawdown versus distance], with the corresponding interpreted "straight lines" necessary for calculations are presented as Figures 8 to 14.

The transmissivity ~~and storativity~~ values calculated for the tapped aquifer using the respective drawdown versus elapsed time, and residual drawdown (recovery) versus elapsed time ratio (t/t') range from 25,400 gallons per day per foot (gpd/ft) to 31,800 gpd/ft, and 1.0×10^{-4} to 8.5×10^{-5}, respectively, with a corresponding average transmissivity value of 29,000 gpd/ft and average storativity value of 9.2×10^{-5} (Table 3). The values of transmissivity and storativity calculated using the distance versus drawdown graph are 35,300 gpd/ft and 8.0×10^{-5}, respectively.

The calculated transmissivity values are considered reflective of the occurrence of a thick sequence of a high permeability formation consistent with the medium sand that comprises the tapped aquifer. The associated storativity values are typical for a confined aquifer which is consistent with the McQueen Branch and its overlying and underlying thick sequences of clay, silt and fine sand. Given the mapped extent of the McQueen Branch and related overlying formations, the source of recharge to the tapped aquifer is primarily attributed to precipitation infiltration occurring in the outcrop region near and parallel to the Fall Line.

Besides being used to calculate local transmissivity values for the tapped aquifer, the graphs of residual drawdown versus elapsed time ratio (t/t') were also used to assess the adequacy of the currently available amount of aquifer recharge relative to the test pumping conditions. The data trends for the respective plots indicate that the extrapolation of the later data (i.e., lower values of t/t') form a line which intercepts the time ratio axis at values of 1 or greater. Based on these projected intercept values, the amount of recharge currently available to the aquifer tapped by Well TW-1 appears to be capable of supporting continuous pumping at a rate of at least 2,406 gpm (about 3.5 MGD).

The distance versus drawdown graph was also used to determine the approximate average "radius-of-influence" for Well TW-1 relative to a pumping rate of 2,406 gpm (Figure 11). The radius-of-influence is typically considered to correspond to the areally average lateral extent in the aquifer beyond which drawdown associated with a specific pumping rate and duration is zero ("r_o"). It is commonly portrayed as being symmetrically distributed about a pumping well, but in reality is often asymmetrical due to the hydraulic influences of

2 Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well field history, Am. Geophys. Union Trans., vol. 27, pp. 526-534.

aquifer shape, slope, heterogeneity, and hydrogeologic boundaries (e.g., buried bedrock ridges, geologic formation changes). The radius-of-influence calculated for Well TW-1 based on data collected from the constant-rate pumping test, under long-term pumping at 2,406 gpm, is approximately 20,000 feet (or about 3.8 miles). The calculated radius-of-influence and corresponding laterally-defined zone-of-contribution are well within the areal extent of the corresponding aquifer. As such, the pumping of Well TW-1 at 2,406 gpm does not exceed available aquifer recharge and adversely impact the local groundwater resources.

Groundwater Quality

The water discharged during the constant-rate test of Well TW-1 did not exhibit evidence of entrained air or sediment throughout the 72-hour duration pumping period. The water discharged from Well TW-1 during the pumping period exhibited an average temperature of 84 degrees Fahrenheit (°F) throughout the test, consistent with what would be expected given the location and depth of the aquifer. Other field parameters measured at the pump discharge sampling port indicate that the respective water-quality conditions were relatively consistent throughout the duration of the test (Table 4). Specifically, conductivity did not deviate more than +/- 0.07 milli-siemens per centimeter (mS/cm) for the final 24 hours of the pumping period. In addition, pH readings did not fluctuate more than +/- 0.14 standard units (SU) throughout the final 24 hours of the test, though there was a slight increase over time which stabilized at the end of the pumping period.

The analytical results for the six discharge water samples collected for Well TW-1 over the duration of the test were generally consistent between samples and reflective of reported groundwater quality conditions associated with the downgradient portion of the McQueen Branch aquifer (Table 5). No anthropogenic compounds (i.e., from human activity) were detected, though of the detected compounds/parameters, several naturally-occurring ones exceed the current SCDHEC "secondary" drinking water standards so the groundwater is not considered "pristine." These are fluoride, aluminum, sodium and total dissolved solids (TDS), and pH at average concentrations of 2.4 milligrams per liter (mg/L), 0.251 mg/L, 245 mg/L, 518.5 mg/L, and 8.83 standard units (SU), respectively. In addition, the Department of Health and Human Services recommends an optimal fluoride level of 0.7 mg/L. However, since the use of groundwater pumped from Well TW-1 is intended for cooling purposes, and not as a drinking water supply, the treatment necessary to make the water viable as a "potable" (drinkable) source is not necessary. Such a need for treatment underscores the appropriateness of groundwater pumped from this aquifer to be used as a non-potable supply, rather than from an aquifer of naturally-occurring higher quality water.

GROUNDWATER FLOW MODEL OF WELL TW-1 IMPACTS

Though Well TW-1 was test pumped at an average rate of 2,406 gpm (3.5 MGD), Maguro is currently applying for permission to pump at a daily rate average rate of 1.5 MGD to meet its anticipated demands. A determination of the necessary peak instantaneous rate for operations at the site has not yet been finalized, but will most likely be approximately 2,400 gpm. As such, the effects of the proposed pumping of Well TW-1 at a rate of 1.5 MGD on the local and regional groundwater resources were assessed using a numerical three-dimensional groundwater flow model. No changes were made to the USGS-provided model input data (e.g., hydrogeologic parameters and pumping demands of others, circa 2004) used to establish the projected impacts for a groundwater withdrawal of 0.5 MGD used in support of the previous application submitted and approved in 2015.

Groundwater Flow-Model Development

To conduct this assessment, the publicly available version of the Regional Aquifer System Analysis (RASA) South Carolina Coastal Plain model (the Model) developed by the USGS (SIR 2007-5126) was modified relative to anticipated on-site pumping conditions, and site-specific hydraulic characteristics with respect to the McQueen Branch aquifer, and used to project corresponding changes in groundwater levels. The Model uses the USGS MODFLOW finite difference code, with input values and parameters based on site-specific and regional hydrogeologic characteristics, and aquifer recharge values determined from available published reports.

The Model is described in detail in the USGS report entitled "Hydrogeology and Simulation of Ground-Water Flow near Mount Pleasant, South Carolina – Predevelopment, 2004, and Predicted Scenarios for 2030" (USGS SIR 2007-5126). The Model was based on the regional domain for the aquifer system provided in its published form and inclusive of aquifer characteristics published by others. To conduct the simulations necessary to evaluate the impacts of the proposed pumping conditions, two new "stress periods" (SPs) were added to the 29 SPs existing in the original model. Except as discussed below, the added SPs (SP30 and SP31) assumed boundary conditions and aquifer properties similar to those as the final stress period of the published model (SP29).

The domain (grid extent) assumed by the Model roughly corresponds to the regional extent of the South Carolina Coastal Plain; to the north and south of the Site, westward to the outcrop areas (the Fall Line) of the deepest aquifer units (e.g., McQueen Branch), and eastward beyond the Atlantic coastline (Figure 15). The majority of "cells" comprising the grid correspond to unit areas of the aquifer system of 10,000 feet by 10,000 feet. The exception occurs for those cells located near the Site, which are modified to 1,000 feet by 1,000 feet in area to provide for higher resolution of modeled water levels. In addition, better resolution of modeled water level data for immediately around the Site and Well TW-1 was provided by modifying the corresponding cells to 250 by 150 feet in area. The utilized Model allows for hydraulic interaction between the subsurface formations and perennial streams, as well as 'leakage' into aquifers from overlying and underlying 'confining' bed or 'aquitards.' Both grade topography and bedrock surface topography are accounted for in the modeled aquifer system (i.e., unit thickness variation with slope or "dip"). The Model treats the Coastal Plain aquifer system as nine "layers" consisting of five aquifers and four alternating aquitards (Figure 1).

To project the amount of drawdown that would occur from the 1.5 MGD groundwater withdrawal from the McQueen Branch aquifer currently being proposed by Maguro, two scenarios were modeled. The first modeled simulation (A) represented continuous pumping from the aquifer system under USGS-specified regional pumping conditions for 2004. This simulation was completed to provide a baseline for comparison subsequent purposes. The second modeled simulation (B) was used to overlay the impact of the proposed maximum daily pumping rate of 1.5 MGD from the Well TW-1 on the aquifer system. Steady-state conditions were assumed for projecting the impact of the proposed withdrawal by utilizing a long-term, continuous pumping duration of 25-years. The residual impact of the proposed pumping was assessed by determining the recovery period necessary to return the groundwater levels near the Site to non-pumping conditions.

Estimated Aquifer Parameters

For the Model to best simulate site-specific conditions and resulting aquifer impacts, the results obtained from the recent pumping test of Well TW-1, conducted from January 15 through 18, 2015, were used to modify the default USGS model aquifer characteristics where appropriate. Specifically, the median hydraulic conductivity value reflected in the USGS input for the Model for the McQueen Branch (Middendorf) aquifer is 46 feet per day (ft/d). However, based on the local aquifer characteristics calculated from the recent test data, a hydraulic conductivity value of 20 ft/d was used for the McQueen Branch aquifer in the modeled simulations. By using the lower site-specific hydraulic conductivity value, rather than the higher model-default value, a more conservative projection of the influence of the proposed pumping was developed by the model. Similarly, the default specific storage values (storativity) for the McQueen Branch aquifer were modified from 2.5×10^{-6} to 4.5×10^{-7} to reflect the calculated local conditions based on the aquifer testing results. All remaining Model layers are based on the default input hydraulic characteristics. These modifications to the original Model input values result in a good correlation between the observed and projected water-level responses in the McQueen Branch relative to the recent long-term (72+ hour) pumping test (Figure 16).

Groundwater Flow Modeling Results

To project the impact of the proposed groundwater diversion at a rate of 1.5 MGD, a pumping center was added to the Model corresponding to the location of Well TW-1. To this end the proposed demand associated with Well TW-1 was simulated by a stress (pumping) applied at Model cell 75:122:7, which corresponds to Row: 75, Column: 122, and Layer 7 (McQueen Branch aquifer). The withdrawal rates for regionally distributed pumping wells as per SP29 and set by the USGS based on diversion amounts reported by local water purveyors for the 2004 calendar year were used for the background Model conditions. All pumping rates used in the Model simulations were averaged over the length of the corresponding stress period.

Simulation A was used to establish background stresses on the aquifer system based on the 2004 reported withdrawal rates. Simulation B incorporated the pumping of Well TW-1 at a rate of 1.5 MGD for stress period SP30 set to a 25-year long-term pumping duration and SP31 set to a 5-year duration.

A map of the projected drawdown conditions for the McQueen Branch aquifer resulting from the proposed groundwater withdrawal from Well TW-1 at 1.5 MGD after 25 years of continuous pumping is presented in Figure 17. The extent based on a 25-year duration reflects "steady-state" conditions, meaning that the simulated duration of pumping is adequate to result in no appreciable growth of the resulting extent of the "zone of influence". The extent of the projected corresponding drawdown contours reaches westward towards the outcropping area of the McQueen Branch aquifer, as well as eastward towards the Atlantic Ocean. The Model results indicate that the projected maximum drawdown which would occur under the proposed pumping conditions is approximately 61 feet for Model cell 75:122:7, which corresponds to the aquifer in the immediate vicinity of Well TW-1 (Figure 17). Output files from the Model runs are presented on a CD provided as Appendix B to this report.

As previously discussed, the Model simulations incorporate pumpage from the Crouch Branch and McQueen Branch aquifers occurring as of 2004 from locations throughout the region including major pumping centers in the Charleston area. It has been documented that most of this pumpage has since discontinued, as the respective well users have switched to surface water sources to meet their respective public water supply demands. As such, the recently modeled conditions represent a "worse" case (extremely conservative) scenario relative to projected pumpage impacts since they reflect the long-term effects on the regional groundwater resources associated with large capacity groundwater users which no longer exist.

Aquifer Recharge

Natural recharge to the aquifer materials underlying the Site and surrounding areas occurs primarily by the infiltration of precipitation where the aquifer encounters the ground surface roughly corresponding to a region parallel to the Fall Line located over 100 miles to the west of the Site. Similarly, overlying and underlying formations may serve as sources of natural recharge.

The water level recovery data trends associated with the recently completed long-term (72+ hour) aquifer test indicate that the McQueen Branch aquifer tapped by Well TW-1 receives adequate natural recharge to support long-term pumpage of at least 3.5 MGD. Likewise, the Model was used to assess the potential recharge capability relative to long-term pumping (i.e., 25 years) at a rate of 1.5 MGD, which is significantly less than the projected local natural recharge rate of the aquifer (at least 3.5 MGD) and consistent with the currently proposed withdrawal request of Maguro for the Site.

The Model results project that after 25 years of continuous pumping at 1.5 MGD, the water level for Well TW-1 and the nearby observation wells recover to within 90% of the respective pre-pumping static water levels within 2.5 years of pumping cessation. This projected response indicates that a more than adequate amount of natural recharge is currently available for the McQueen Branch aquifer relative to the projected pumping of 1.5 MGD continuously for 25 years. Besides the previously discussed conservative assumptions of background pumpage associated with previous conditions in 2004, the Model also is based on conservative conditions in that it assumes an average recharge rate for the McQueen Branch aquifer by precipitation infiltration of 3.9 inches per year (in/yr) corresponding to a drought period rate versus the more typically reported 10 to 12 in/yr (again very conservative over 25 years).

Impacts on Existing Groundwater Users

As anticipated, the maximum drawdown conditions resulting from the proposed withdrawal at Well TW-1 will occur in the McQueen Branch aquifer (Figure 17; Table 6). Based on available information, the following facilities have been identified as being affiliated with supply wells tapping the McQueen Branch aquifer proximal to the Site: Celanese Corp. (about 3 miles northeast); Berkeley County Water and Sewer Authority (BCWSA; about 7.5 miles north), and Nucor Steel (about 10 miles southeast). Of these, the closest is Celanese Corp. The maximum drawdown projected to occur in the McQueen Branch aquifer at the Celanese Corp. property well is less than 22 feet (Figure 17). Given the depth of wells tapping the McQueen Branch in the area and a corresponding anticipated standing column of water in excess of 1,000 feet, the amount of projected drawdown is not considered to be significant relative to any measureable impact on the production capability of a Celanese Corp. supply well. The respective amounts of projected drawdown for the BCWSA and Nucor Steel sites are only about 16 feet and 14 feet, respectively. Given the reported aquifer thickness and corresponding static water level reported for each of these wells, the projected drawdown is considered to be relatively insignificant.

Beyond the nearby Celanese Corp., BCWSA, and Nucor Steel wells, there are seven wells reportedly tapping the McQueen Branch Aquifer located in an area about 20 miles southeast of the Site. The model-based projected drawdown for the aquifer at this location is about 11 feet. Thirteen wells are identified as being completed in the McQueen Branch aquifer proximal to the area bounded by model-projected 5-foot drawdown zone of influence resulting from the proposed pumping of Well TW-1 at 1.5 MGD. It should be noted that based on the reported completion depth of the respective wells compared to the reported depth to the top of the McQueen Branch aquifer at the corresponding locations, several of these may instead be completed in the overlying Crouch Branch aquifer. The model-projected impacts (less than one foot), based on the simulated pumping of Well TW-1 at 1.5 MGD, are minimal for the Crouch Branch Aquifer, and so, the same can be assumed for any wells tapping this aquifer. No wells tapping the shallow Floridian aquifer are projected to be impacted by the simulated pumpage. This projection is further substantiated by the observation that no measurable water level change was noted at the nearby off-site Santee Redi Mix Site well during the pumping test of Well TW-1 at 2,406 gpm (3.5 MGD).

Based on the lack of influence observed at the nearby well tapping the Floridan aquifer and Model projections, the McQueen Branch aquifer is hydraulically isolated from the local water table system and affiliated nearby wetlands and surface-water bodies. Therefore, the proposed pumping of Well TW-1 is projected to have no effect on any of these nearby surface-water systems. Furthermore, a comparison of reported pumpage data for the McQueen Branch aquifer provided by the SCDHEC for 2004 (year assumed by USGS) shows that the statewide demands on the aquifer generally have not changed as recently as 2016 (Figure 18). As such, the projected impacts of the proposed pumping of Well TW-1 at 1.5 MGD are expected to be similar under current (circa 2017) conditions.

GROUNDWATER MANAGEMENT

As indicated previously, the Site is located in the Trident Capacity Use Area which covers 3,160 square miles and comprises all of Berkeley, Charleston, and Dorchester Counties. In accordance with the South Carolina Groundwater Use and Reporting Act, the SCDHEC adopted in May 2017 a Groundwater Management Plan for the Trident Capacity

Use Area (TA GWMP). The three general goals of the TA GWMP include: 1) management of groundwater withdrawals to ensure sustainable development of the resource; 2) protection of groundwater quality from salt-water intrusion; and 3) monitoring groundwater quality and quantity to evaluate conditions.

Groundwater Use Summary

As reported by SCDHEC in the TA GWMP as of 2015, approximately 46.4% of the groundwater diversions reported for the Trident Area were used for public water utility supply, 34.6% was used for industry; and 9.6% was used for golf course irrigation. The remaining roughly 10% was used for agricultural irrigation and thermal power. The corresponding usage breakdown reported by the SCHDEC indicated that for 2015, approximately 65.9 % of groundwater use for these supplies was pumped from the "Charleston" (Charleston/McQueen Branch) aquifer. According to the TA GWMP, overall groundwater use (combination of public water supply, industrial use, golf courses, and irrigation) in the Trident Area has reportedly declined by approximately 2,300 MGY from all aquifers from 2004 to 2015; however, population and water usage is projected to increase over the next 10 to 15 years.

As part of the TA GWMP, the SCDHEC has identified strategies to conserve and protect the groundwater resources of the Trident Area. These strategies include considering impacts from actual and proposed future water use, prioritizing types of use by aquifer and need, establishing an expanded groundwater level monitoring program, and identifying appropriate conservation measures.

Groundwater Monitoring Program

In addition to development of a BMP for the Site, the conditions of the existing Groundwater Withdrawal Permit require that Maguro install an Automatic Data Recorder (ADR) to monitor groundwater levels in the McQueen Branch aquifer by using in one of the observation wells completed in the same aquifer as Well TW-1. This effort is aligned with the strategies of the TA GWMP.

Although Maguro has not initiated pumping of Well TW-1 at the Site yet, an ADR was installed in Well MW-1 in October 2016. The collected measurements indicate a gradual increase in groundwater levels in the McQueen Branch aquifer from October 2016 through March 2017, and generally stable groundwater levels from April 2017 to present (Figure 19). The data also indicate a periodic and rapidly rebounding decline of about two feet in the local groundwater level, likely caused by interference from an off-site pumping well.

Maguro will continue to operate the ADR at Well MW-1 as part of a Site groundwater monitoring program to continue to collect baseline water level data and to document impacts of the use of Well TW-1 when it is placed into service. This data will be used to compare local groundwater levels in the McQueen Branch aquifer to those upgradient and downgradient of the Site (Figure 20). Maguro will use these comparisons along with pumpage and precipitation data to help manage its groundwater use, and comply with the goals and strategies of the TA GWMP.

SUMMARY

The following is a summary of the conclusions and proposed actions based on the results of the hydrogeologic assessment and alternatives analyses completed in connection with the proposed use of Well TW-1 as a proposed 1.5 MGD source of non-contact cooling water for the Maguro Site:

1) Hydrogeologic conditions encountered in connection with the installation of two observation wells and one production well at the Site indicate the occurrence of three aquifers, each separated by fine-grained confining units. The Floridan aquifer extends from about 200 ft bg to 500 ft bg, the Crouch Branch aquifer extends from about 1,150 ft bg to about 1,400 ft bg, and the McQueen Branch aquifer extends from about 1,570 to about 1,690 ft bg.

2) Based on the encountered aquifer materials, a large-diameter "test" well (Well TW-1) and two small diameter observation wells (MW-1 and MW-2) were constructed at the Site. Well TW-1 was completed as a double cased 14-inch diameter, gravel packed well with 40-slot screens set from 1,582 to 1,597 ft bg and from 1,612 to 1,682 ft bg, respectively.

3) Based on the hydrogeologic conditions prevailing at the time of the corresponding long-term (72+ hour) duration constant-rate pumping test of Well TW-1, the respective well and tapped unconsolidated aquifer is capable of locally supporting pumping at a rate of at least 2,400 gpm (3.5 MGD). The corresponding recovery response and aquifer/drainage basin recharge characteristics indicate that the currently available recharge is capable of locally supporting additional pumpage. As such, the proposed pumping of Well TW-1 at 1.5 MGD is expected to have proportionately less of an impact on the McQueen Branch aquifer.

4) Projections using an existing USGS three-dimensional numerical groundwater flow model (RASA) modified for site-specific hydrogeologic conditions indicate that the conservatively projected proposed long-term (25 years)

pumping of Well TW-1 continuously at a rate of 1.5 MGD could result in about 5 feet of water level change (drawdown) in the McQueen Branch aquifer at a distance of about 30 miles from the Site. These projections are extremely conservative in that they assume significant regional background pumpage which no longer occurs, and recharge amounts from precipitation infiltration significantly reduced from the reported typical amounts. Twenty-six supply wells reportedly tapping the McQueen Branch aquifer occur within the area bounded by the model-projected 5-foot drawdown limit. Based on the depth of the McQueen Branch aquifer and corresponding static water levels occurring at the respective well locations, no adverse impacts on the production capability of these nearby wells from the proposed groundwater diversion of 1.5 MGD at the Maguro facility is anticipated.

5) The results of actual pumping tests and modeling efforts indicate that the proposed pumping of Well TW-1 by Maguro at 1.5 MGD is not anticipated to result in any adverse impact to the local water resources and existing groundwater users.

6) An assessment of the feasibility of developing alternative groundwater sources indicate that the Floridan aquifer is a possible option. However, development of the Floridan aquifer as a groundwater supply source for the Site was avoided due to concerns over potential impacts on local private and residential well owners who use their supplies as a potential sole source, and local wetlands and surface-water.

7) Groundwater from the McQueen Branch aquifer is readily available, with sufficient quantity and quality to make it very suitable for use as a source of non-contact cooling water for the Site. In order to maximize the number of cooling cycles attained and to reduce the amount of chemicals needed, Maguro will be investing in an ion exchange softening system. Best Management Practices have been documented for the optimum operation of the system to reduce waste and conserve water.

8) Maguro initiated continuous on-site groundwater level monitoring at its Monitor Well MW-1 completed in the McQueen Branch aquifer using an ADR in October 2016. The groundwater level monitoring program at the Site will continue to assess the effects of the use of Well TW-1 on the tapped aquifer and be used to compare on-site pumpage impacts to regional groundwater level and precipitation trends. This effort is considered consistent with the TA GWMP developed by the SCDHEC.

LEGGETTE, BRASHEARS & GRAHAM, INC.

Zachary Tyczka
Senior Hydrogeologist

Karen Benson, PG
Associate/Hydrogeologist

Frank Getchell, PG (SC No. 2673)
Senior Vice President/Hydrogeologist

TABLES

TABLE 1

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

Well Construction Summary

Well ID[1]	Elevation Top of Casing (ftamsl)[2]	Total Depth (ft.bg.)[3]	Screen Interval (ft. bg.)	Diameter (inches)	Latitude	Longitude	Distance from Pumping Well (feet)	Static Water Level (ft. btoc)[4] (1/15/15)
TW-1	43.42	1684	1582-1597, 1612-1682	14	33.0648935	-80.047782	---	53.65
MW-1	44.87	1645	1605-1645	4	33.067618	-80.037917	3181	56.48
MW-2	43.22	1645	1615-1645	4	33.060932	-80.038280	3246	54.83
Offsite Well[5]	NA[6]	302	NA	6	33.057684	-80.033290	5160	53.76

Notes:
1) Well Identification: See Figure 2 for locations.
2) Feet above mean sea level.
3) Feet below grade.
4) Feet below top of casing.
5) Supply well for Santee Redi Mix Site
6) NA denotes information is not available.

TABLE 2

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

Well TW-1 Constant Rate Pumping Test Data Summary for January 15-18, 2015

Well	Static Water Level (ft. btoc)[1] (1/15/15))	Pumping Water Level (ft. btoc) (1/18/15)	Drawdown (feet)	% Recovery after 24 hours (%)
TW-1	53.65	225.12	171.47	92.2
MW-1	56.48	86.66	30.18	58.50
MW-2	54.83	85.54	30.71	58.90

Notes:
1) Feet below top of casing

TABLE 3

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

Calculated Aquifer Coefficients

Method	Cooper-Jacob		Theis Recovery	
	T[1]	S[2]	T	S
TW-1	27,600	N/A[3]	25,400	--
MW-1	25,400	8.36E-05	30,200	--
MW-2	31,800	1.01E-04	31,800	--
Distance-Drawdown	35,300	7.94E-05	--	--

Average T: 29,700
Average S: 9.0E-05

Notes:
1) T - Transmissivity, in gpd/ft.
2) S - Storage coefficient, dimensionless.
3) N/A denotes not applicable.

TABLE 4

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

Field Water Quality Summary

Date	Time	pH (s.u.)	Cond. mS/cm	Turb. * (NTU)	DO (mg/l)	Temp. (^{0}C)	ORP (mV)	TDS (g/L)	DTW (ftbtoc)	Notes
1/15/2015	8:14	8.88	0.987	192	3.91	30.85	-142	0.631	172.3	
1/15/2015	8:23	8.91	0.978	95	3.59	30.95	-152	0.625	176.03	Lab Sample 1 - 8:30
1/15/2015	8:37	8.74	0.977	43.4	0.93	32.96	-232	0.626	179.85	
1/15/2015	8:53	8.90	0.982	19.4	NC	32.52	-206	0.624	185.27	
1/15/2015	9:01	8.91	0.980	14.0	1.34	32.54	-273	0.627	185.98	
1/15/2015	9:15	8.80	0.972	13.1	0.79	32.18	-275	0.620	188.17	
1/15/2015	9:35	8.94	0.959	9.3	0.70	31.80	-287	0.615	190.62	
1/15/2015	9:55	8.93	0.965	9.1	4.81	31.52	-206	0.613	192.52	
1/15/2015	10:20	8.96	0.950	7.4	3.45	31.04	-202	0.608	196.54	Chloride : 12 mg/L**
1/15/2015	10:45	8.95	0.948	4.9	1.89	30.15	-188	0.606	NC	
1/15/2015	11:02	8.95	0.957	6.2	1.20	31.80	-211	0.611	198.33	
1/15/2015	11:32	8.95	0.940	2.9	0.71	31.15	-234	0.598	199.73	
1/15/2015	12:02	8.96	0.926	1.7	0.57	30.24	-201	0.595	200.98	Lab Sample 2 - 12:30
1/15/2015	12:35	8.97	0.934	3.2	NC	30.81	-183	NC	203.5	
1/15/2015	13:01	8.97	0.931	1.9	1.65	29.62	-213	0.596	204.48	
1/15/2015	13:33	8.92	0.937	22.3	0.25	32.41	-245	0.601	205.36	
1/15/2015	14:02	8.96	0.949	0.0	0.21	32.47	-302	0.609	206.31	
1/15/2015	14:32	8.96	0.946	6.5	0.21	32.38	-307	0.609	207.08	
1/15/2015	15:02	8.97	0.937	6.0	0.18	32.08	-310	0.603	207.72	
1/15/2015	15:32	8.97	0.938	8.2	0.18	32.19	-313	0.600	208.18	
1/15/2015	16:15	8.98	0.931	8.2	0.80	31.92	-307	0.594	NC	Lab Sample 3 - 16:30
1/15/2015	18:30	8.99	0.951	2.3	2.23	32.11	-310	0.608	207.95	Chloride : 10 mg/L
1/15/2015	19:30	8.98	0.941	NC	0.29	31.89	-311	0.600	215.19	Pumping Rate Decreased
1/15/2015	20:30	9.00	0.959	NC	0.18	31.72	-310	0.618	215.55	
1/15/2015	21:30	9.00	0.936	NC	0.77	31.26	-305	0.597	NC	
1/15/2015	22:30	8.99	0.922	NC	0.14	30.74	-304	0.592	216.21	
1/15/2015	23:30	8.99	0.935	NC	0.26	30.53	-300	0.595	NC	
1/16/2015	0:30	9.00	0.932	NC	0.20	31.11	-300	0.615	216.31	
1/16/2015	1:30	8.99	0.963	NC	0.19	31.14	-294	0.613	NC	
1/16/2015	2:30	8.99	0.955	NC	1.70	30.99	-172	0.611	217.37	
1/16/2015	3:30	9.00	0.948	NC	3.10	30.88	-164	0.609	NC	
1/16/2015	4:30	9.00	0.945	NC	2.44	30.39	-183	0.609	217.85	
1/16/2015	5:30	9.01	0.952	NC	2.73	30.08	-283	0.609	NC	
1/16/2015	6:35	8.90	0.971	12.7	0.32	32.12	-290	0.618	214.73	
1/16/2015	7:23	8.99	0.952	10.4	1.21	31.95	-313	0.607	215.19	Lab Sample 4 - 7:30
1/16/2015	9:09	8.91	0.970	55.6	2.07	32.47	-208	0.616	NC	
1/16/2015	10:22	8.97	0.968	0.0	NC	32.88	-320	0.620	216.21	Lab Sample 5 - 11:30
1/16/2015	11:58	8.84	0.989	61	1.51	33.29	-247	0.634	NC	
1/16/2015	12:31	8.98	0.987	4.2	0.35	33.30	-317	0.632	216.31	
1/16/2015	14:33	8.98	0.978	5.3	1.40	33.16	-317	0.626	217.37	Chloride : 12 mg/L
1/16/2015	16:35	9.01	0.976	5.5	1.76	33.17	-333	0.624	217.85	
1/16/2015	18:30	9.02	0.974	6.2	0.36	33.10	-340	0.623	218.37	
1/16/2015	20:30	9.03	0.982	6.5	0.68	33.00	-342	0.630	218.8	
1/16/2015	22:30	9.02	0.978	7.3	1.22	32.91	-343	0.622	219.2	
1/17/2015	0:30	9.02	0.972	7.2	1.25	32.90	-344	0.622	219.64	
1/17/2015	2:30	9.01	0.973	7.7	1.27	32.84	-345	0.622	221.2	
1/17/2015	4:30	9.03	0.984	7.9	0.63	32.74	-346	0.630	221.67	
1/17/2015	6:30	9.03	0.978	8.4	1.90	32.76	-347	0.625	221.87	Pump off at ~7:00
1/17/2015	8:48	8.96	0.988	52.6	3.31	31.76	-177	0.632	202.49	Pump on at ~ 8:25
1/17/2015	9:07	8.97	0.981	19.2	1.22	31.86	-233	0.624	207.01	
1/17/2015	9:33	8.98	0.959	19.6	0.60	31.94	-247	0.614	209.32	
1/17/2015	10:01	9.01	0.946	20.4	0.39	31.84	-247	0.606	211.08	Chloride : 14 mg/L
1/17/2015	10:38	9.01	0.937	21.7	0.27	31.94	-241	0.599	NC	
1/17/2015	12:26	9.02	0.942	26.1	1.80	32.21	-253	0.600	NC	Chloride : 12 mg/L
1/17/2015	13:47	9.05	0.947	44.2	0.72	32.09	-271	0.606	217.42	
1/17/2015	14:55	9.05	0.949	32.4	0.48	32.07	-277	0.614	217.88	
1/17/2015	17:32	9.06	0.972	33.4	0.46	32.88	-330	0.622	NC	
1/17/2015	18:49	9.06	0.970	24.7	1.22	32.80	-337	0.620	220.10	
1/17/2015	19:54	9.06	0.991	11.5	0.32	33.41	-342	0.635	222.37	Lab Sample 6 - 20:00
1/17/2015	21:00	9.05	0.987	9.2	0.36	33.30	-339	0.631	222.76	
1/17/2015	22:00	9.06	0.982	9.1	0.67	33.42	-344	0.628	223.03	

TABLE 5

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

Laboratory Water Quality Summary

Parameter Qualifier Result	Units	15-Jan-15 8:30	15-Jan-15 12:30	15-Jan-15 16:30	16-Jan-15 7:30	16-Jan-15 11:30	17-Jan-15 20:00	Average
Carbon Analysis								
Total Organic Carbon #1	mg/L	2.04	2.16	2.22	2.31	2.3	2.29	
Total Organic Carbon #2	mg/L	2.5	2.4	2.49	2.43	2.42	2.64	
Total Organic Carbon #3	mg/L	2.17	2.46	2.44	2.53	2.46	2.59	
Total Organic Carbon #4	mg/L	2.37	2.35	2.3	2.37	2.47	2.36	
Total Organic Carbon Average	mg/L	2.27	2.34	2.36	2.41	2.42	2.47	**2.38**
Ion Chromatography								
Fluoride	mg/L	2.38	2.4	2.4	2.4	2.41	2.41	**2.4**
Nitrate-N	mg/L	0	0	0	0	0	0	**0**
Nitrite-N	mg/L	0	0	0	0	0	0	**0**
Sulfate	mg/L	0	0	0	0	0	0	**0**
Chloride	mg/L	13.2	13.4	13.2	13.2	13.3	13.3	**13.3**
Metals Analysis-ICP								
Aluminum	mg/L	0.251	0	0	0	0	0	**0.042**
Arsenic	mg/L	0	0	0	0	0	0.0082	**0.0014**
Barium	mg/L	0.00463	0.00433	0.00459	0.00463	0.00458	0.00434	**0.0045**
Boron	mg/L	1.82	1.8	1.76	1.8	1.79	1.69	**1.78**
Calcium	mg/L	1.63	1.15	1.08	0.998	0.985	0.979	**1.14**
Copper	mg/L	0.0055	0	0.0264	0.00385	0	0	**0.0060**
Iron	mg/L	0.272	0.0737	0.0656	0.0375	0.0336	0.0392	**0.0869**
Magnesium	mg/L	0.211	0.166	0.16	0.153	0.153	0.153	**0.166**
Manganese	mg/L	0.00606	0.00419	0.00423	0.00438	0.00438	0.00449	**0.0046**
Molybdenum	mg/L	0	0	0	0	0	0.00248	**0.00041**
Potassium	mg/L	1.74	1.72	1.66	1.69	1.71	1.56	**1.68**
Silica	mg/L	17.5	16.6	16.1	16.3	16.3	16.4	**16.5**

TABLE 5

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

Laboratory Water Quality Summary

Parameter Qualifier Result	Units	15-Jan-15 8:30	15-Jan-15 12:30	15-Jan-15 16:30	16-Jan-15 7:30	16-Jan-15 11:30	17-Jan-15 20:00	Average
Silicon	mg/L	8.13	7.68	7.48	7.6	7.54	7.64	**7.68**
Sodium	mg/L	245	243	240	251	248	225	**242**
Strontium	mg/L	0.026	0.0228	0.0222	0.0222	0.0219	0.0214	**0.0228**
Zinc	mg/L	0.0116	0.00423	0.094	0.00968	0	0.00563	**0.0209**
Micro-biology								
Dissolved Oxygen	mg/L	8.43	6.1	8.84	7.27	6.34	2.16	**6.52**
BOD, 5 DAY	mg/L	0	0	0	0	0	1.29	**0.22**
BOD, 5 DAY Carbonaceous	mg/L	0	0	0	0	0	0	**0**
Nutrient Analysis								
Nitrogen, Ammonia	mg/L	0.343	0.337	0.325	0.324	0.416	0.35	**0.349**
Phosphorus, Total as P	mg/L	0.125	0.21	0.105	0.113	0.125	0.124	**0.134**
Oil & Grease Analysis								
Oil and Grease	mg/L	0	0	0	0	0	0	**0**
Rad Gas Flow Proportional Counting								
Alpha	pCi/L	0	0	0	0	0	0	**0**
Radium-228	pCi/L	0	0	1.45	0	0	0	**0.24**
Radium-226	pCi/L	0.719	2.1	0.744	0.877	1.08	0	**0.92**
Solids Analysis								
Total Suspended Solids	mg/L	5.05	1.13	1.11	0	0	0	**1.22**
Total Dissolved Solids	mg/L	526	514	507	536	529	499	**519**
Spectrometric Analysis								
COD	mg/L	11	13.4	39	22.7	32	25	**23.9**
Total Sulfide	mg/L	0	0	0	0	0	0	**0**
Titration and Ion Analysis								
Alkalinity, Total as CaCO3	mg/L	456	461	455	467	455	462	**459**

TABLE 5

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

Laboratory Water Quality Summary

Parameter Qualifier Result	Units	15-Jan-15 8:30	15-Jan-15 12:30	15-Jan-15 16:30	16-Jan-15 7:30	16-Jan-15 11:30	17-Jan-15 20:00	Average
Hardness as CaCO3	mg/L	3.93	3.93	7.86	0	0	3.93	**3.28**
Salinity U	ppth	0	0	0	0	0	0	**0**
pH at Temp 22.8C H	SU	8.83	8.82	8.84	8.84	8.84	8.82	**8.83**
Conductivity	umchos/cm	874	876	869	882	891	888	**880**
Carbon dioxide, Free	mg/L	1.58	1.53	1.50	1.55	1.54	1.52	**1.54**
Wet Chemistry General								
Turbidity H	NTU	3.38	0.750	0.680	0.550	0.440	0.540	**1.057**

TABLE 6

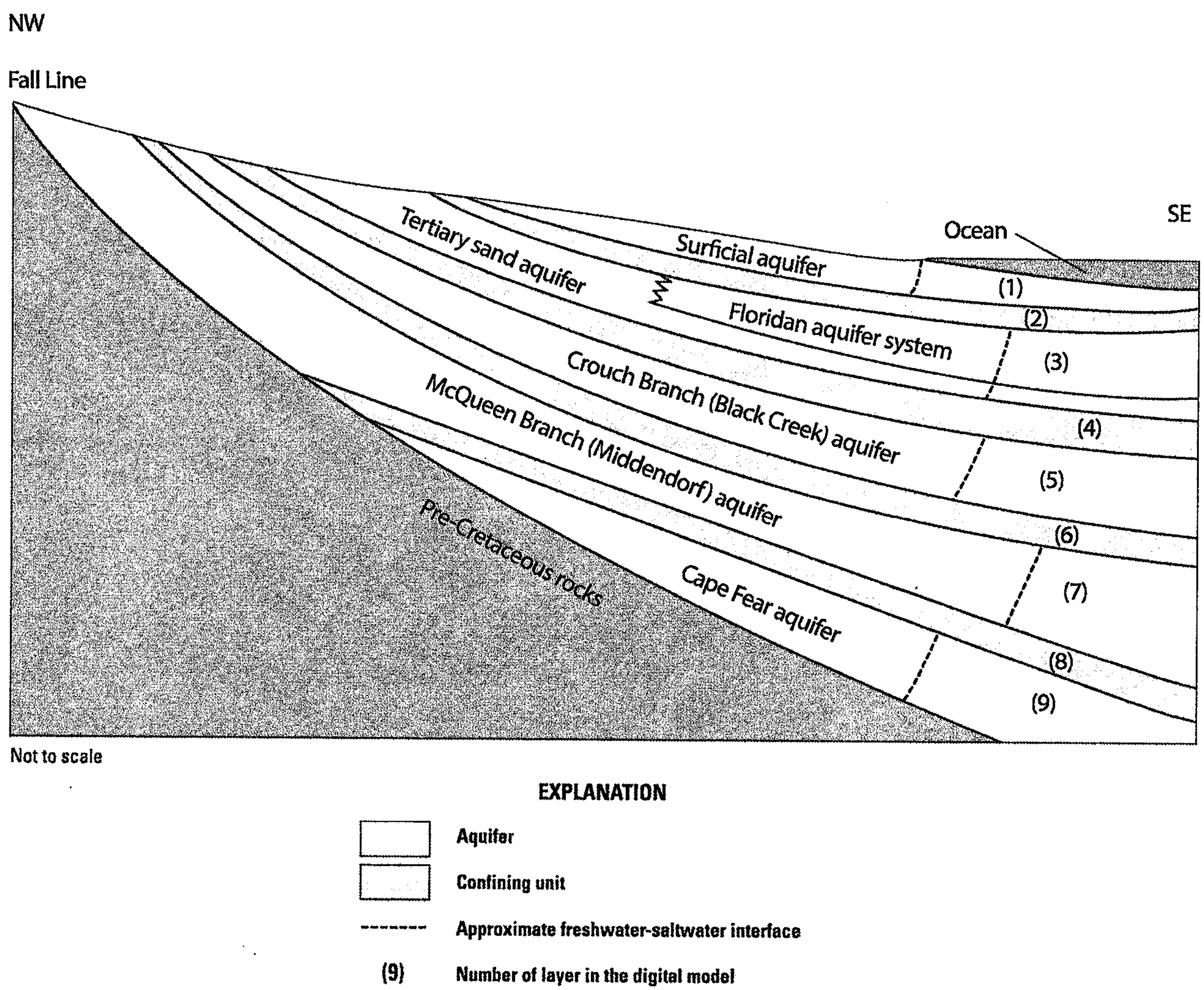
FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

Nearby Wells Tapping the McQueen Branch Aquifer(1)

Well ID(2)	CONUM(3)	OWNER	OWNER WELL	LOCATION	USE(4)
1A	BRK-444	Celanese Corp.		Medway Plantation	IND
2A	BRK-418	BCWSA		Conifer Hall	TEST
2A	BRK-431	BCWSA		Conifer Hall	UNU
1B	BRK-430	Celanese Corp.		Spring Grove Plantation	IND
3A	BRK-655	Nucor Steel	Well 2 (South)		IND
3B	BRK-654	Nucor Steel	Well 1 (North)		IND
6	BRK-83	Albany Felt Co.		St. Stephen	IND
13	CHN-163	Town of Mount Pleasant	Well 38 (Deep Well 1)	King & Simmons Sts	PS
14	CHN-167	Town of Mount Pleasant	Well 39 (Deep Well 2)	Mathis Ferry Rd.	PS
16	CHN-173	Town of Mount Pleasant	Deep Well 3	Boone Hall	PS
17	CHN-174	Seabrook Island		Fire Station	IRR
19	CHN-183	Town of Mount Pleasant		Morgans Point	PS
20	CHN-185	Town of Mount Pleasant		Venning Road	PS
21	CHN-186	Kiawah Island Util.			IRR
22	CHN-187	Isle of Palms	Deep Well 1	Palm Blvd.	IRR
27	CHN-559	Town of Mount Pleasant			PS
29	CHN-603	Town of Isle of Palms			IRR
38	CHN-814	Cassique Kiawaha Resorts		Kiawaha Island	IRR
39	CHN-831	Osprey Point Golf Course	Well 3A	Kiawah Island	IRR
40	CHN-841	Dewees Island	Well #1		PS
41	CHN-842	Dewees Island	Well #2		PS
42	CHN-849	Patriots Point GC		Mount Pleasant	IRR
43	CHN-909	Osprey Point Golf Course		Kiawah Island	IRR
55	GEO-233	GCWSD	N. Santee Well 2		PS
56	WIL-346	Venture Plantation		Salters	IRR
61	BRK-24	George White		Shulerville	PS
62	CLA-197	Tim Helms		Manning	IRR
63	CLA-198	Mike Lane		Foreston	IRR
64	CLA-199	Guerry Green		North Santee	IRR
65	CLA-202	Taw Caw Creek Nursery	Well 2	Summerton	IRR
66	CLA-208	Steven Seueria		Summerton	IRR
67	GEO-376	Bill Johnson		Oatland	DOM
68	ORG-588	Super Sod	Thompson Farm	Bowman	IRR
69	WIL-332	Allen Duke		Workman	DOM
70	WIL-337	Alton Brown, Jr.		Cades	IRR
71	WIL-342	Venture Plantation		Salters	DOM
72	WIL-351	Woody Gamble		Cades	IRR
73	WIL-352	Harry McKenzie		Cades	IRR

Notes:
(1) Based on available well construction and formation depth information.
(2) See Figure 17 for well locations.
(3) County Well Number
(4) IND = industrial; UNU = unused; PS = Public Supply; IRR = irrigation; DOM = domestic

FIGURES



MONCKS CORNER
BERKELEY COUNTY
SOUTH CAROLINA

GEOHYDROLOGIC SECTION ACROSS SOUTH CAROLINA COASTAL PLAIN

repared by:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Services
600 East Crescent Avenue, Suite 200
Upper Saddle River, New Jersey 07458
(201) 818-0700 www.lbgweb.com

			DATE: 07/15/16
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750 500 250 0 750 Feet

Legend

- Test Well
- Observation Well
- Test Well Pump Discharge

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

TEST WELL TW-1 AND OBSERVATION WELL LOCATIONS FOR JANUARY 2015 AQUIFER TEST

Prepared by:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Services
600 East Crescent Avenue, Suite 200
Upper Saddle River, New Jersey 07458
(201) 818-0700 www.lbgweb.com

FILE: B:\MNK\gis\maps\	DRAWN BY: ZT	CHECKED BY: KB	DATE: 07/15/16 FIGURE: 2

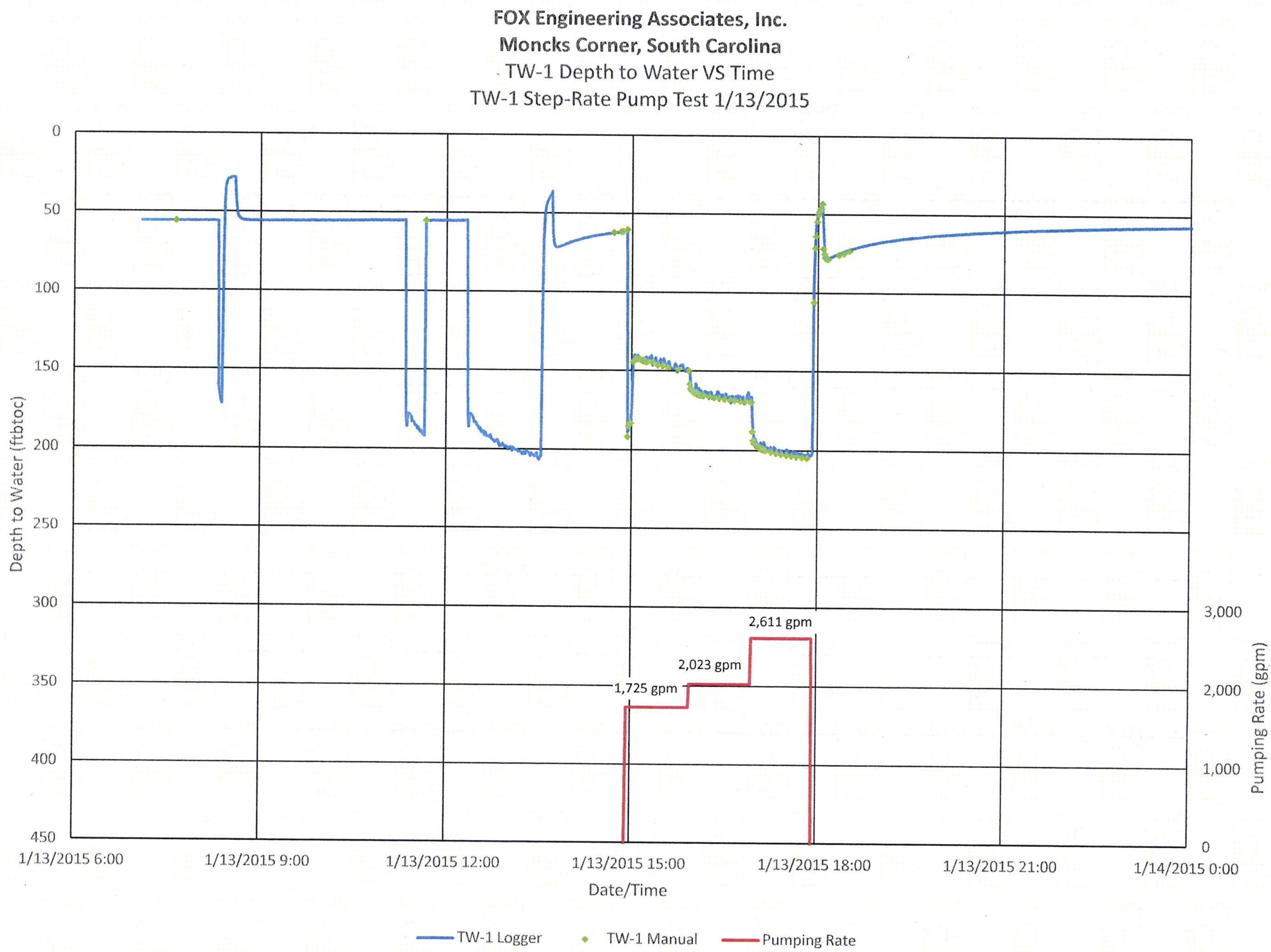


Figure 3

Leggette, Brashears & Graham, Inc.

FOX Engineering Associates, Inc.
Moncks Corner, South Carolina
TW-1 Depth to Water VS Time
TW-1 72-Hour Constant-Rate Pump Test 1/15 - 1/18/2015

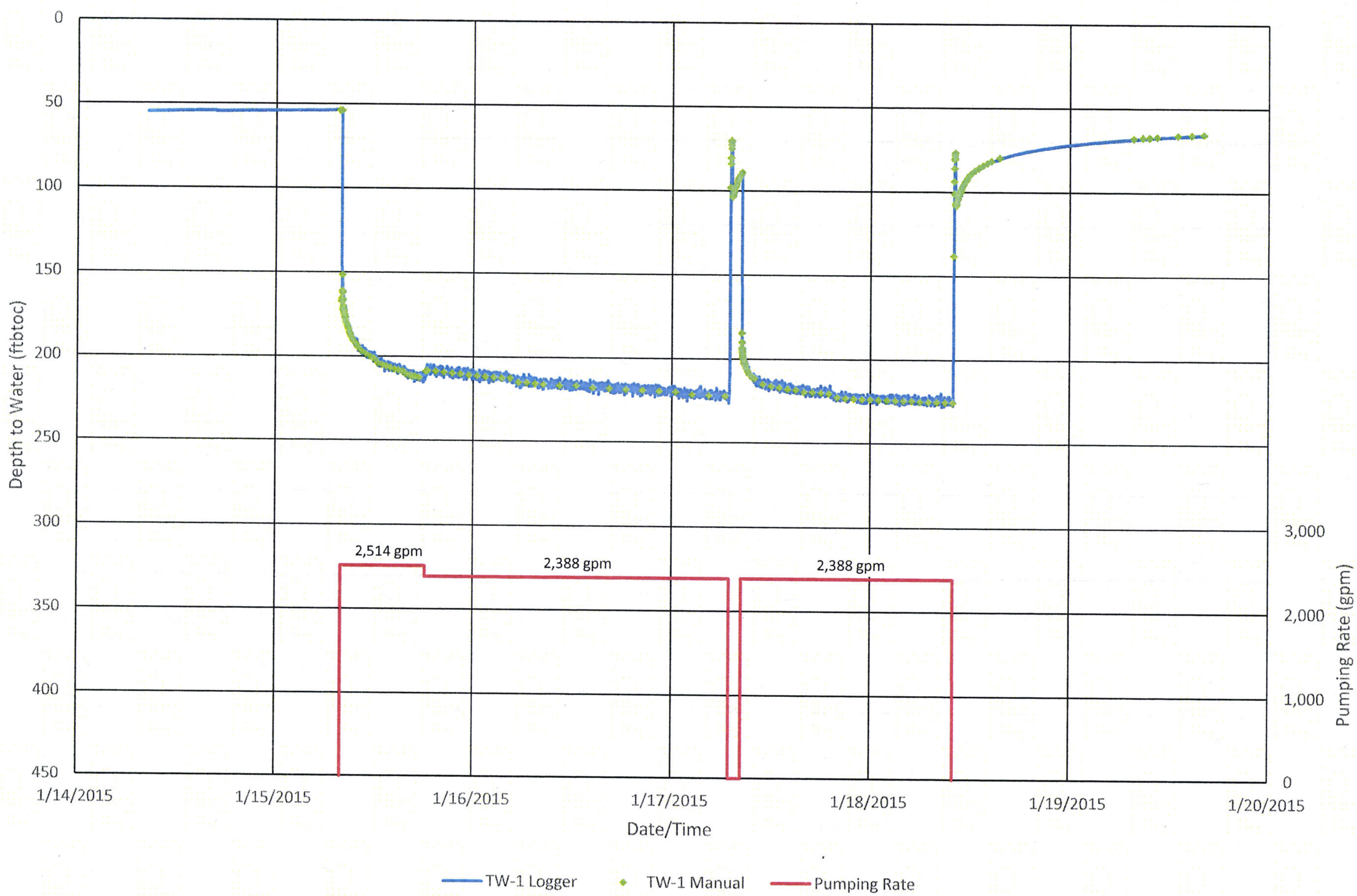


Figure 4

Leggette, Brashears & Graham, Inc.

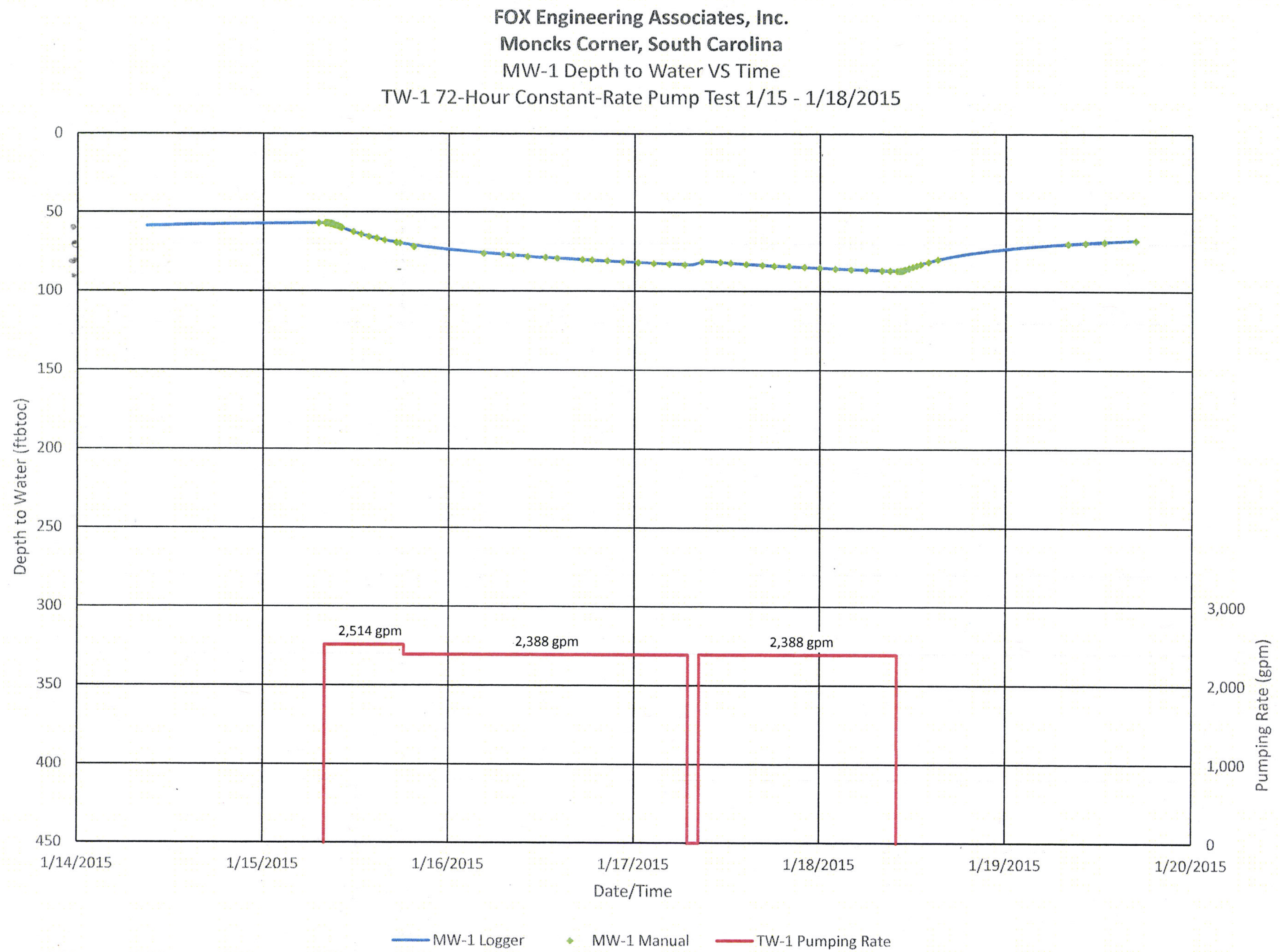


Figure 5

Leggette, Brashears & Graham, Inc.

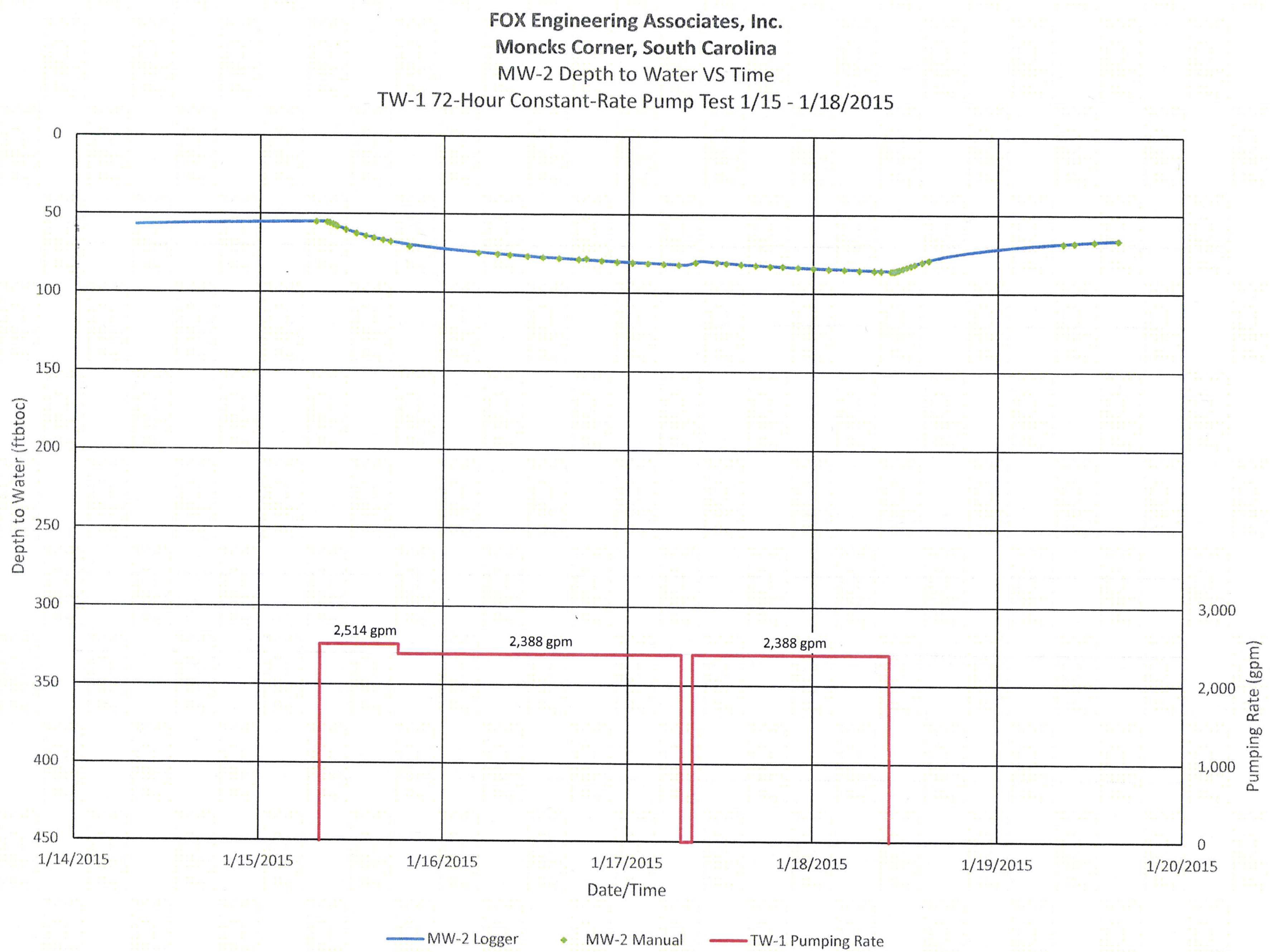


Figure 6

Leggette, Brashears & Graham, Inc.

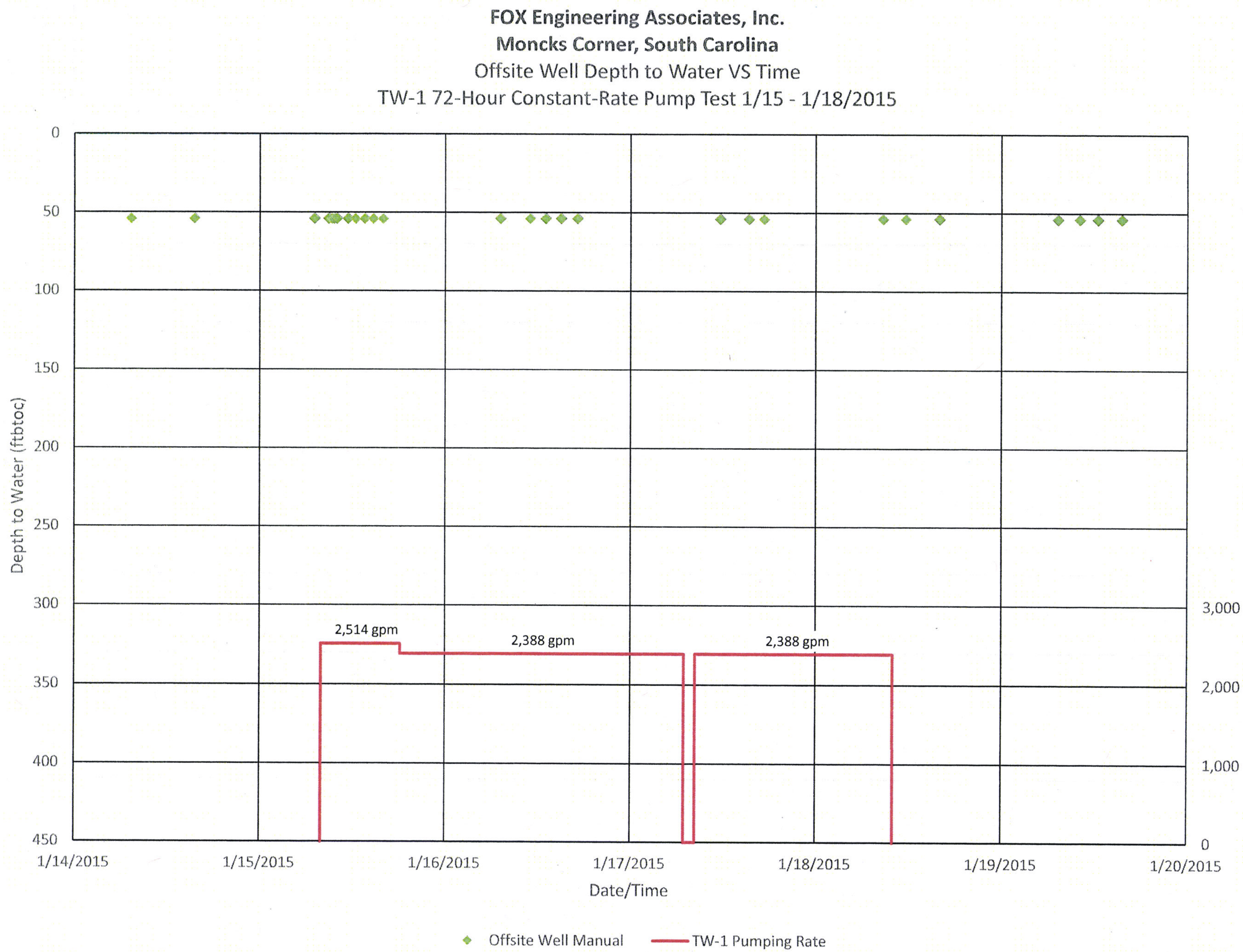


Figure 7

Leggette, Brashears & Graham, Inc.

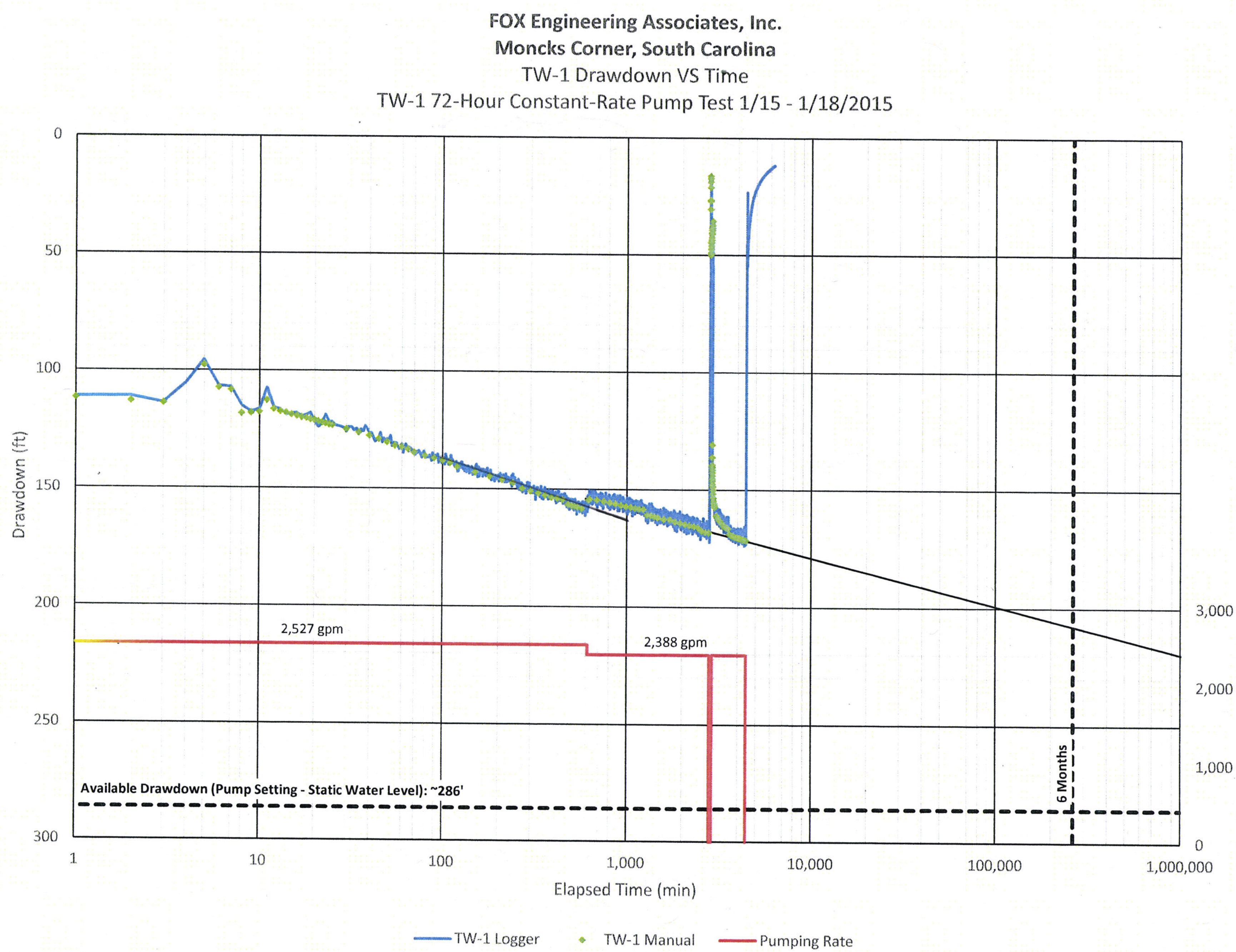


Figure 8

Leggette, Brashears & Graham, Inc.

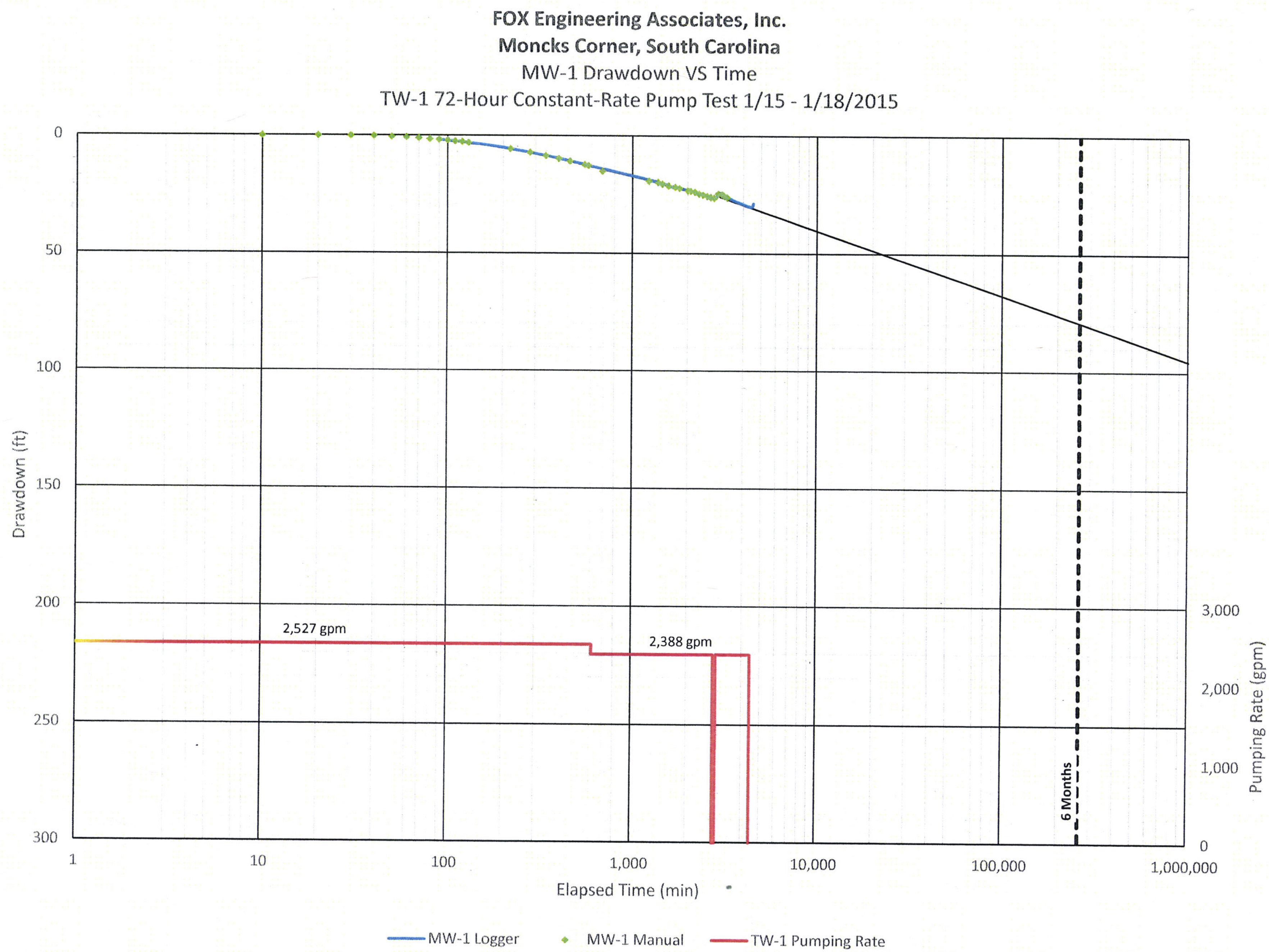


Figure 9

Leggette, Brashears & Graham, Inc.

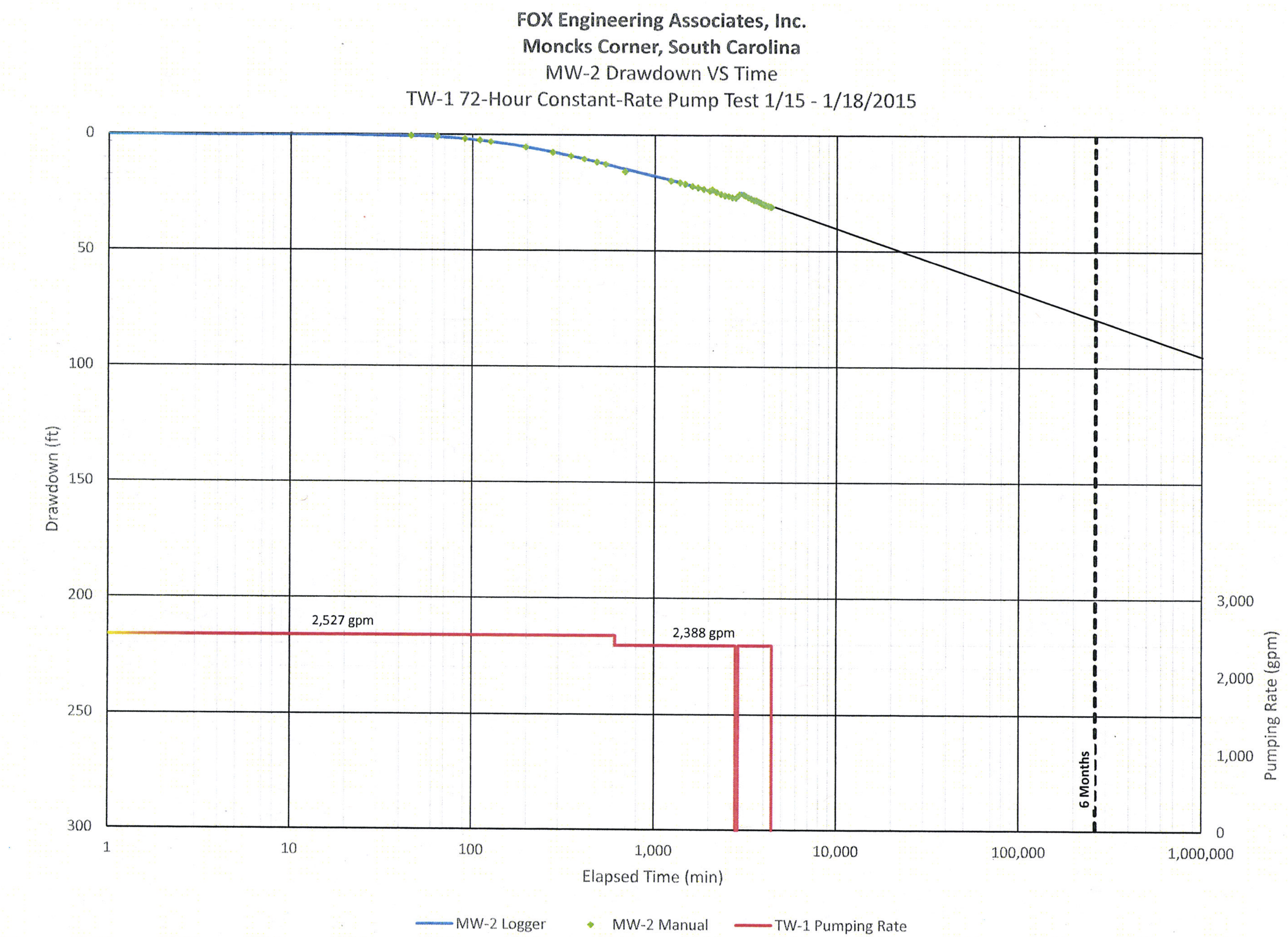


Figure 10

Leggette, Brashears & Graham, Inc.

FOX Engineering Associates, Inc.
Moncks Corner, South Carolina
Distance VS Drawdown
TW-1 72-Hour Constant-Rate Pump Test 1/15 - 1/18/2015

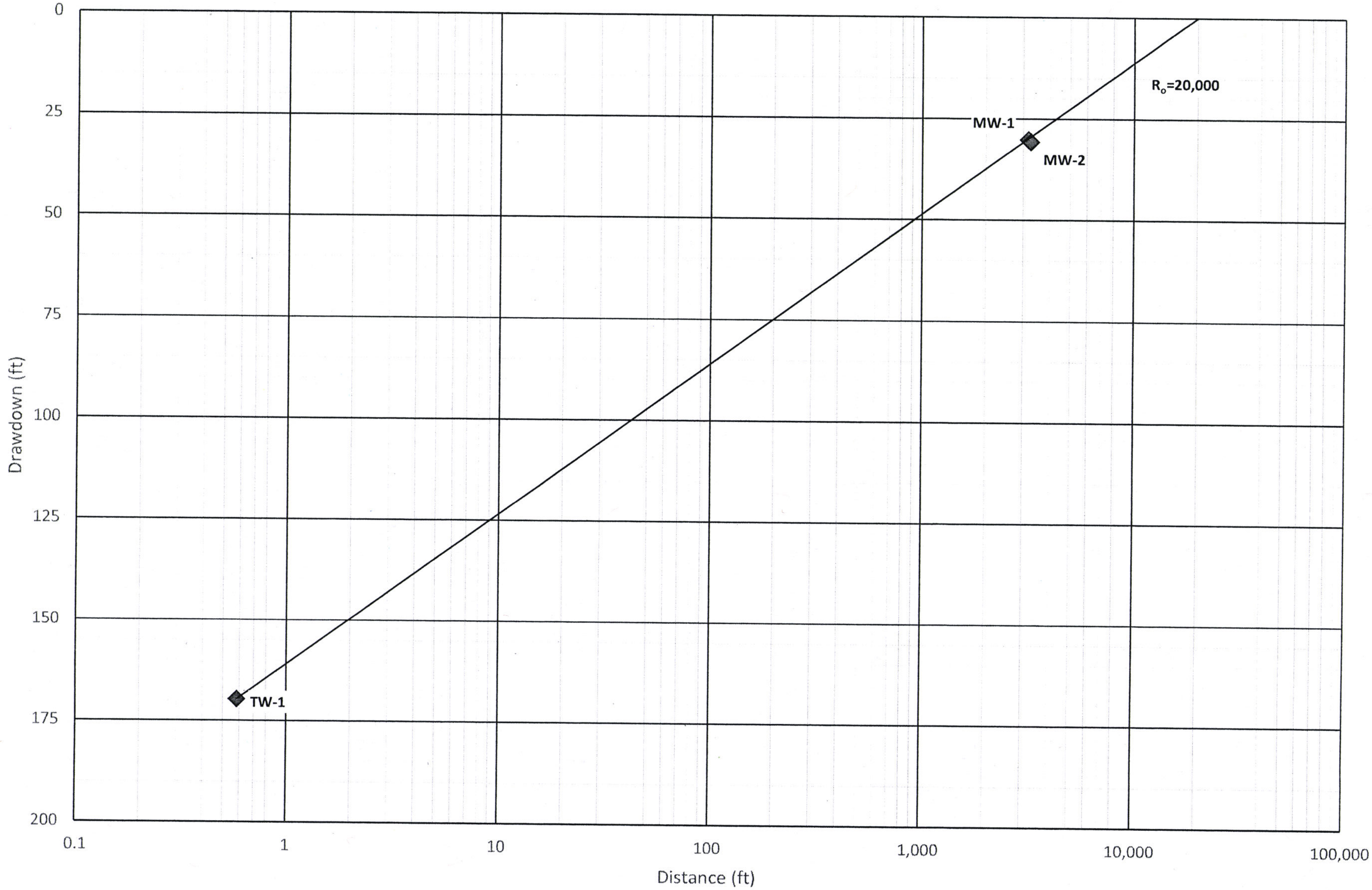


Figure 11

Leggette, Brashears & Graham, Inc.

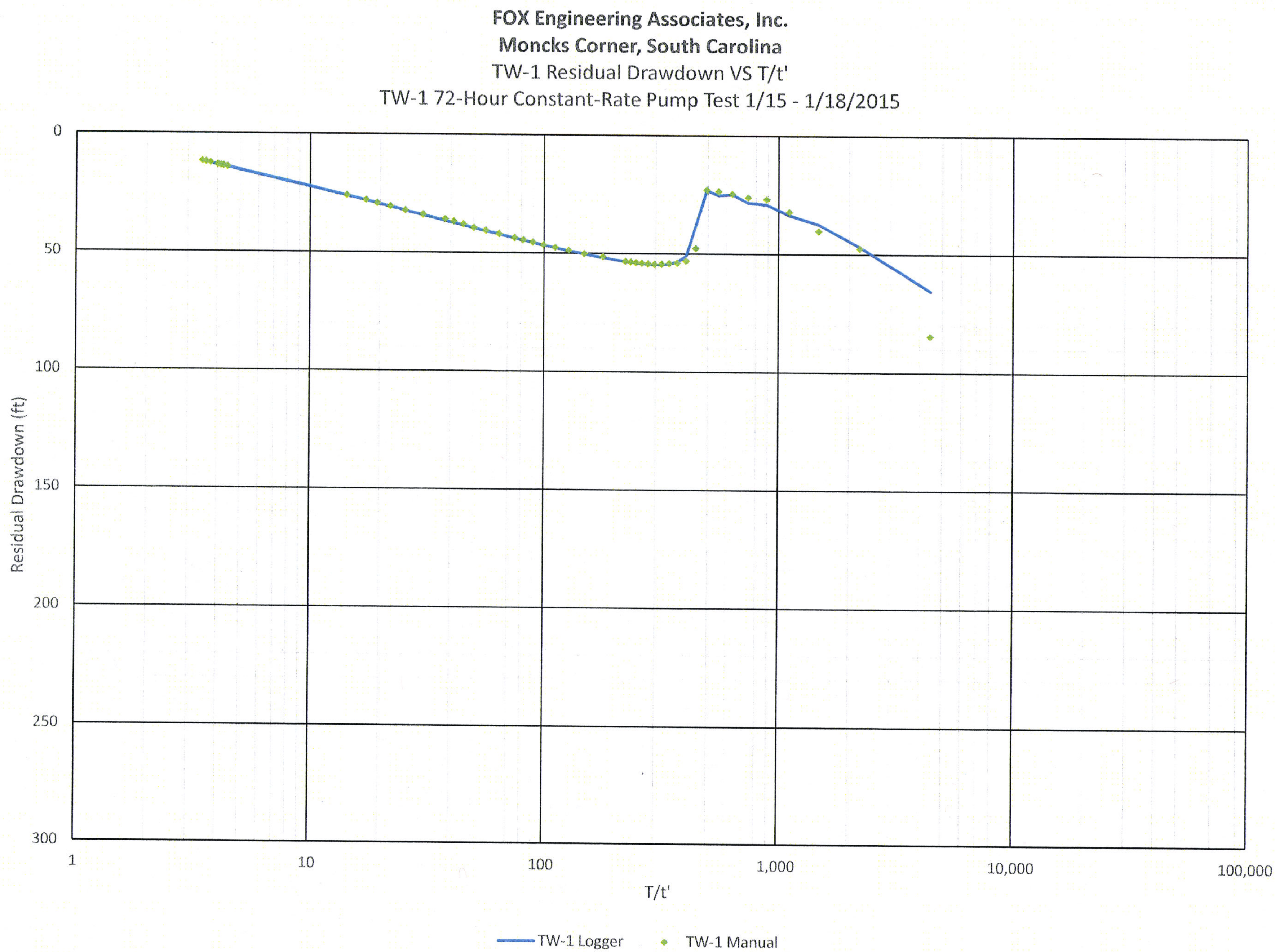
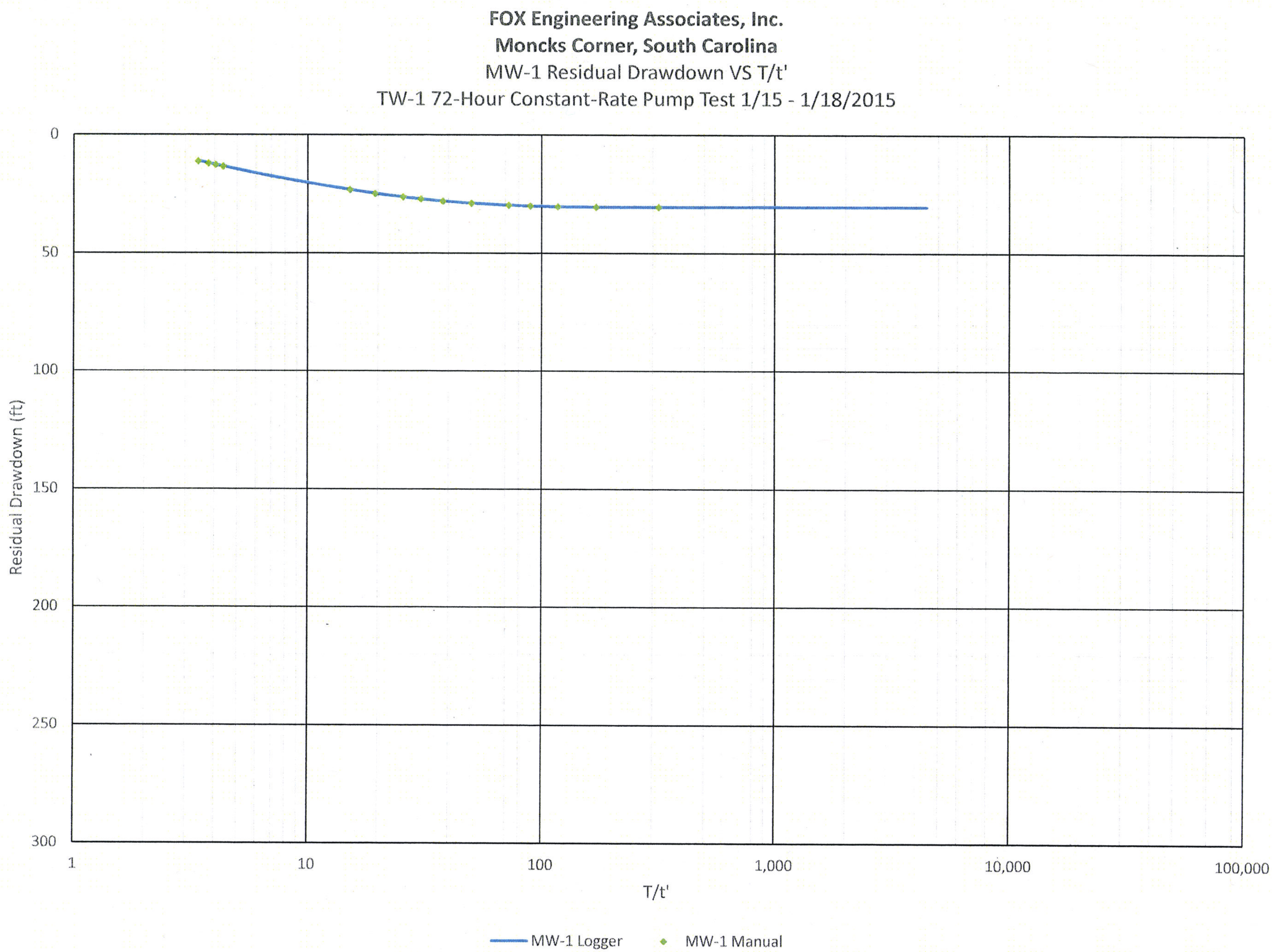


Figure 12

Leggette, Brashears & Graham, Inc.


FOX Engineering Associates, Inc.
Moncks Corner, South Carolina
MW-1 Residual Drawdown VS T/t'
TW-1 72-Hour Constant-Rate Pump Test 1/15 - 1/18/2015
Residual Drawdown (ft)
0
50
100
150
200
250
300
1
10
100
1,000
10,000
100,000
T/t'
MW-1 Logger
MW-1 Manual

FOX Engineering Associates, Inc.
Moncks Corner, South Carolina
MW-2 Residual Drawdown VS T/t'
TW-1 72-Hour Constant-Rate Pump Test 1/15 - 1/18/2015

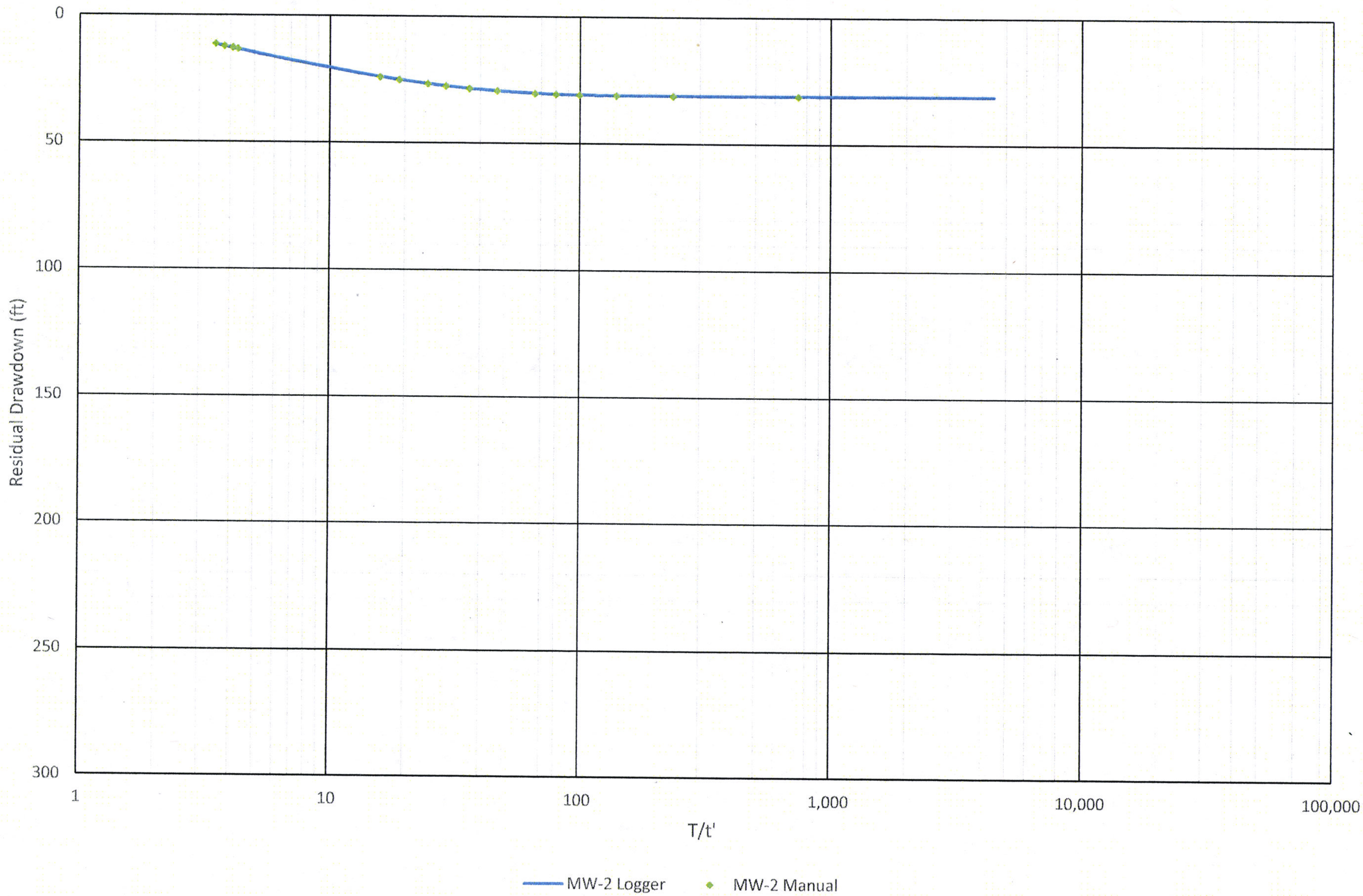
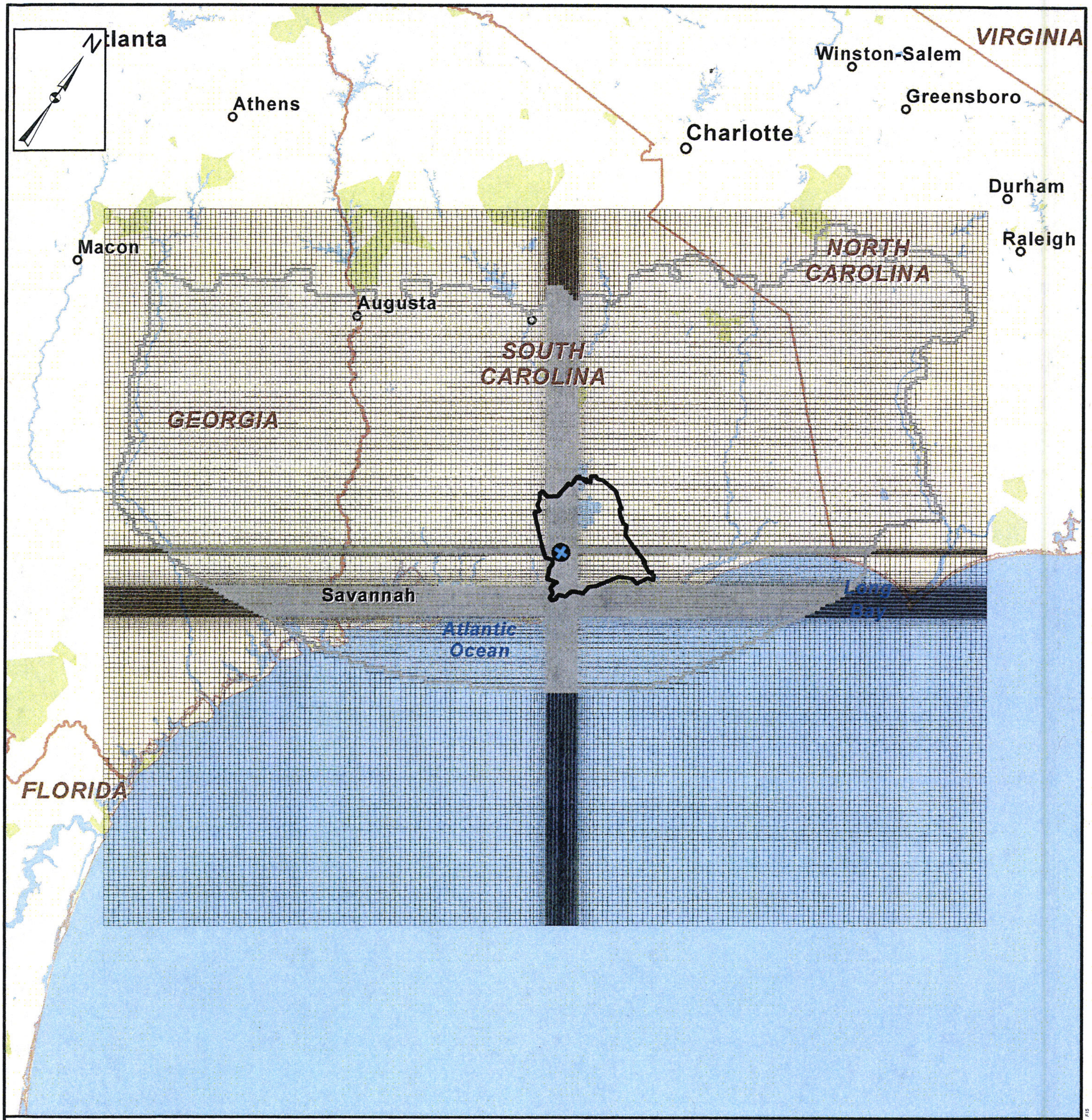


Figure 14



50 25 0 50 Miles

Legend

- Simulated Pumping Well (corresponds to well TW-1 tapping the Middendorf Aquifer; aka McQueen Branch Aquifer)
- Middendorf Aquifer Extent
- Berkeley County
- Model Domain Extent

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

MODEL DOMAIN AND AQUIFER EXTENT

Prepared by:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Services
600 East Crescent Avenue, Suite 200
Upper Saddle River, New Jersey 07458
(201) 818-0700 www.lbgweb.com

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			FIGURE: 15

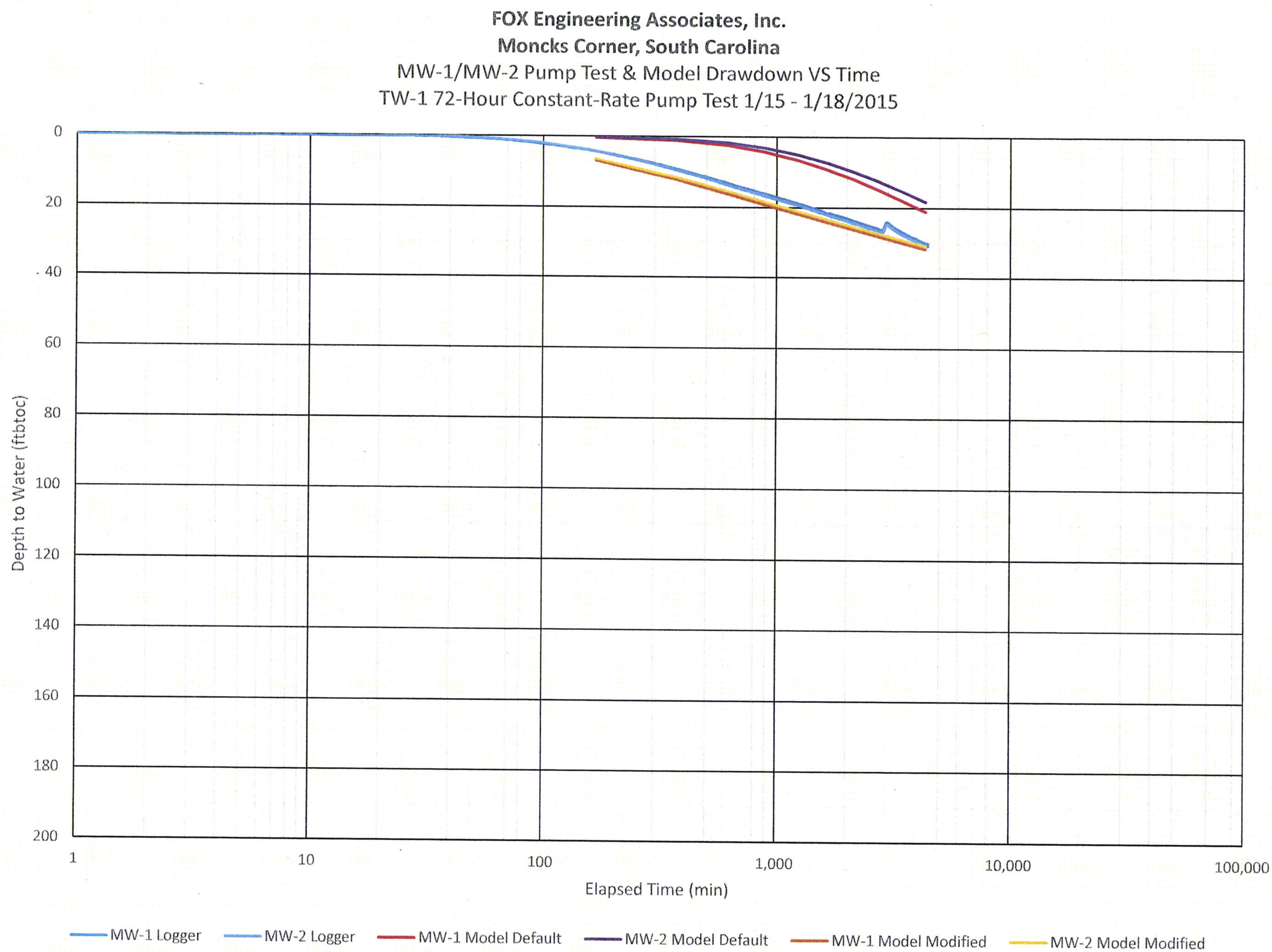
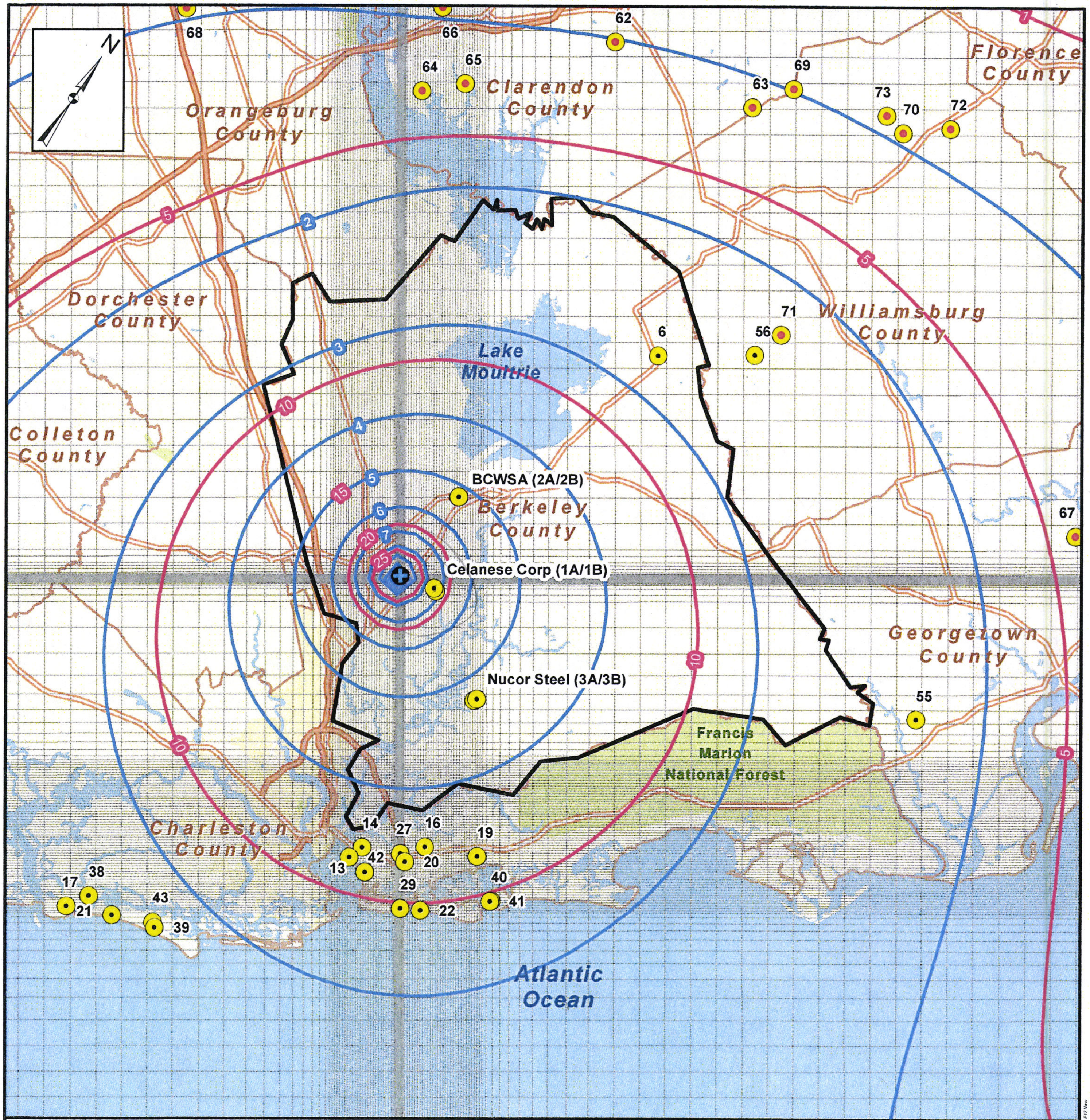


Figure 16

Leggette, Brashears & Graham, Inc.



10 5 0 10 Miles

Legend

- Simulated Pumping Well (corresponds to Well TW-1 tapping the Middendorf Aquifer; aka McQueen Branch Aquifer)
- Identified Well Tapping Middendorf Aquifer
- Reported Existing Well Tapping Middendorf Aquifer
- Projected Drawdown in Feet at 0.5 MGD
- Projected Drawdown in Feet at 1.5 MGD
- Berkeley County

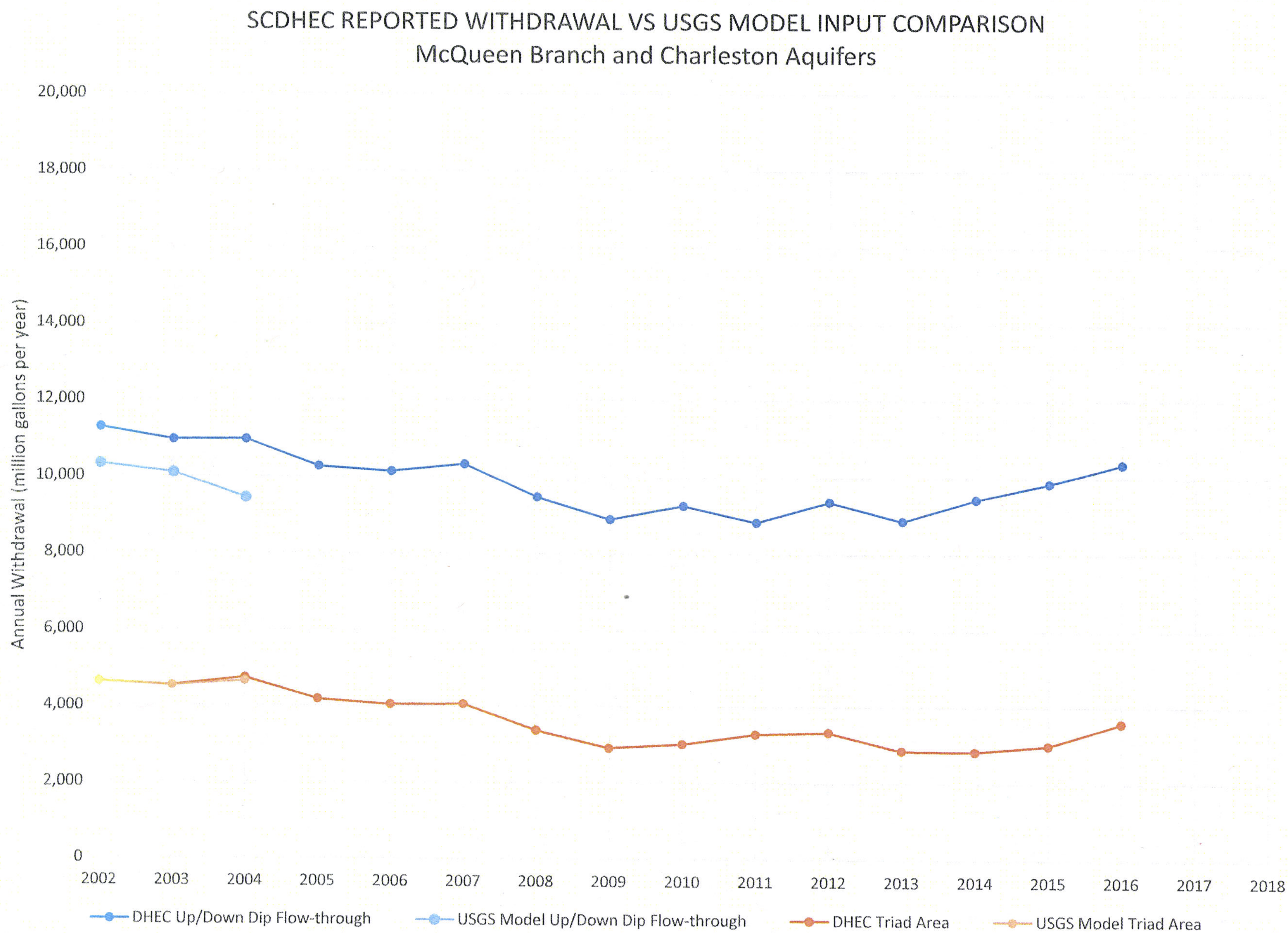
NOTE: See Table 6 in report for well identification

FOX ENGINEERING ASSOCIATES, INC.
MONCKS CORNER, SOUTH CAROLINA

PROJECTED DRAWDOWN MIDDENDORF AQUIFER
0.5/1.5 MGD, FOR 25-YRS CONTINUOUS PUMPING

Prepared by:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Services
600 East Crescent Avenue, Suite 200
Upper Saddle River, New Jersey 07458
(201) 818-0700 www.lbgweb.com

FILE: B:\MNK\gis\maps\	DRAWN BY: ZT	CHECKED BY: KB	DATE: 07/15/16	FIGURE: 17



LEGGETTE, BRASHEARS & GRAHAM, INC.

Figure 18

GROUNDWATER LEVEL MONITORING MAGURO WELL MW-1
MONCKS CORNER, SOUTH CAROLINA

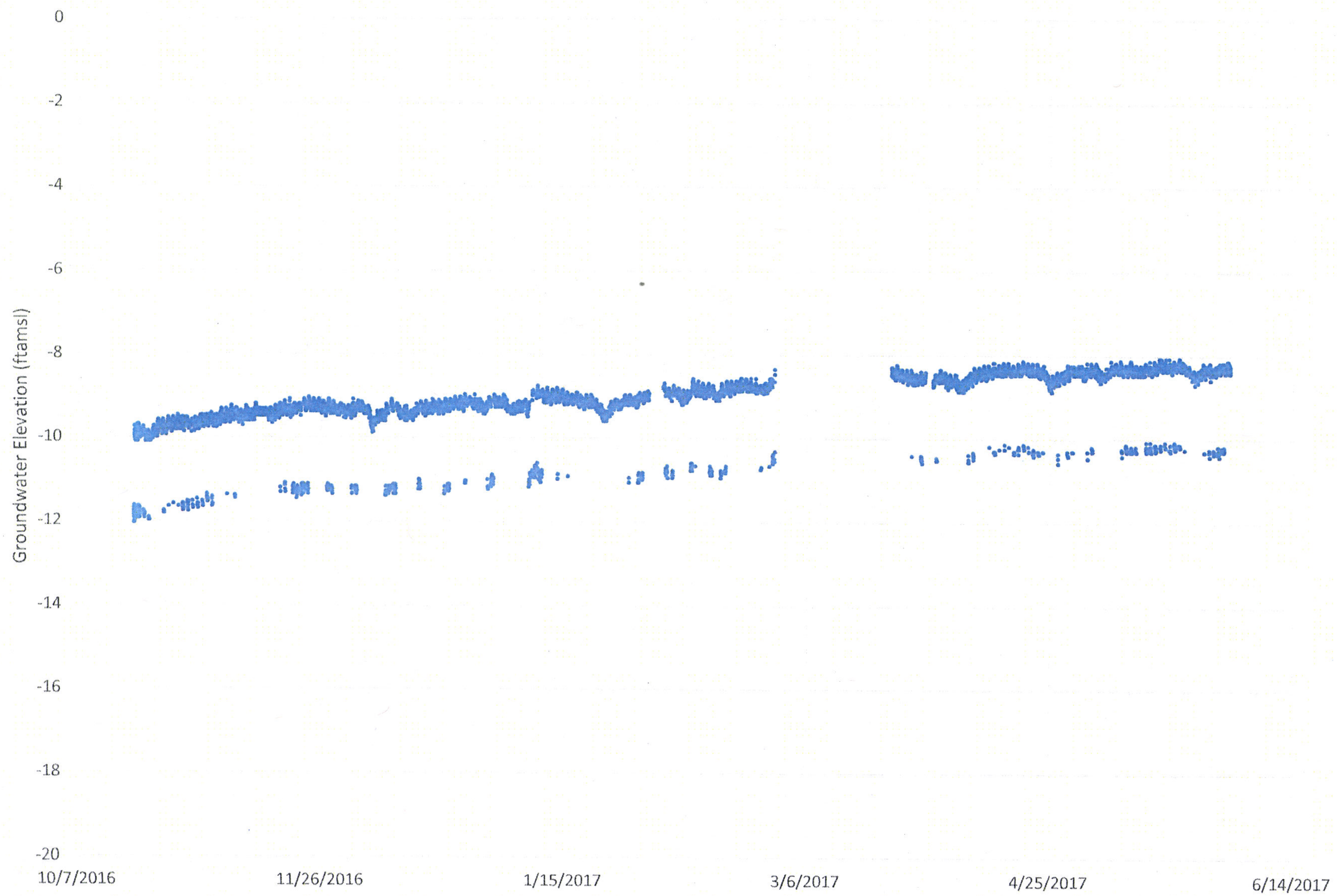
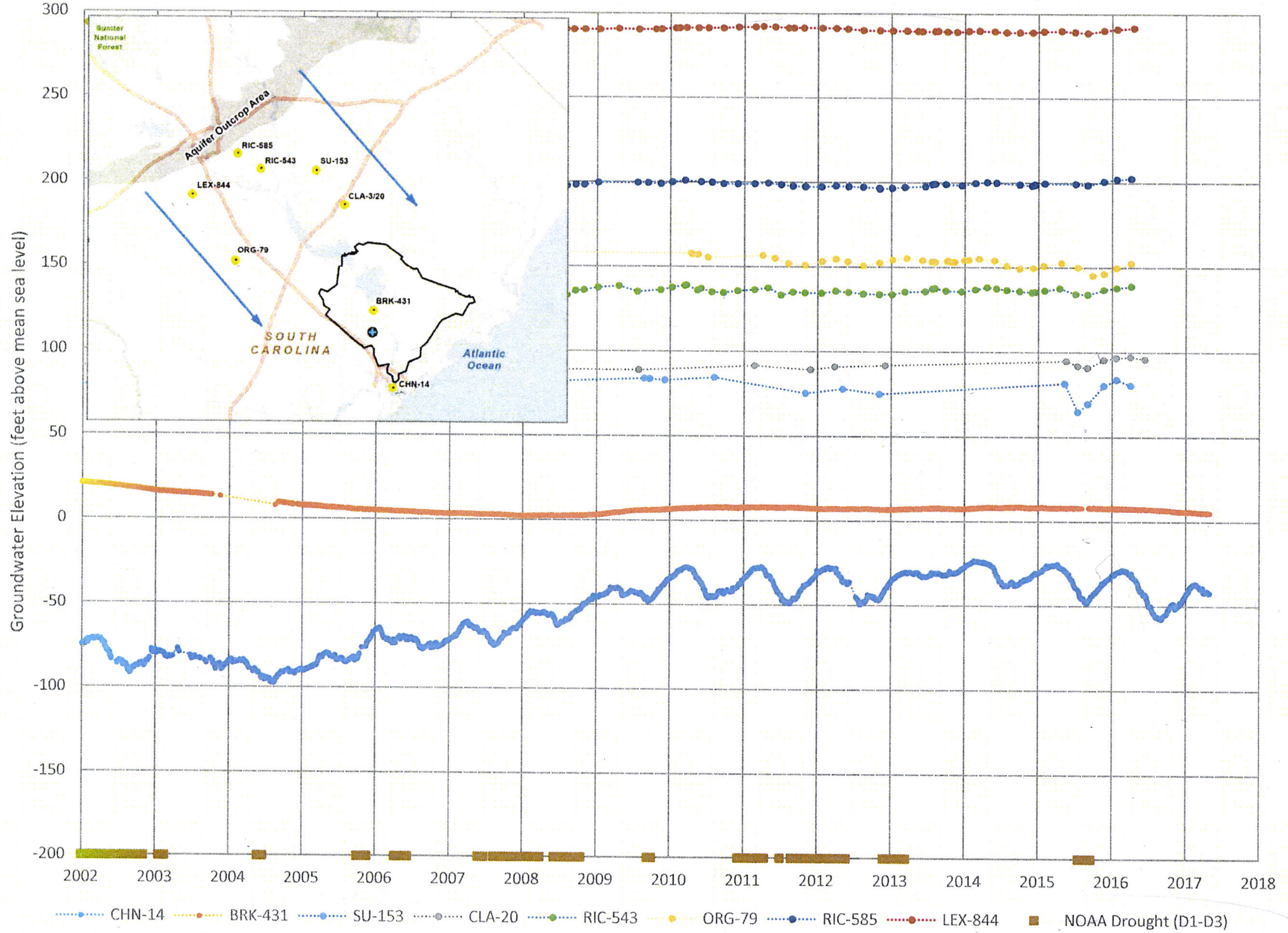


FIGURE 19



Legg ett e, Br ash ear s & Gr ah am In c.

Figure 20

APPENDIX A

WELL LOGS

DHEC
PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 898-4300

1. WELL OWNER INFORMATION:
Name: Maguro Enterprises, LLC
(last) (first)
Address: 1669 Garrott Avenue
City: Moncks Corner State: SC Zip 29461
Telephone: Work: Home:

2. LOCATION OF WELL: **COUNTY:** Berkeley
Name: TW-1
Street Address: 3203 HWY 52
City: Moncks Corner Zip:
Latitude: 33.0648935 Longitude: -80.047782

3. PUBLIC SYSTEM NAME: **PUBLIC SYSTEM NUMBER:**
Not applicable

4. ABANDONMENT: ☐ Yes ☑ No
Give Details Below
Grouted Depth: from ______ ft. to ______ ft.

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
See attached Geologic Log		

*Indicate Water Bearing Zones
(Use a 2nd sheet if needed)

5. REMARKS:

6. TYPE: ☑ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☐ Other

7. PERMIT NUMBER:

8. USE:
☐ Residential ☐ Public Supply ☑ Process
☐ Irrigation ☐ Air Conditioning ☐ Emergency
☐ Test Well ☐ Monitor Well ☐ Replacement

9. WELL DEPTH (completed) Date Started: 10/2/2014
1689 ft. Date Completed: 2/11/2015

10. CASING: ☐ Threaded ☑ Welded
Diam.: 26" / 20" / 14"
Type: ☐ PVC ☐ Galvanized ☑ Steel ☐ Other
20" in. to 1570 ft. depth
14" in. to 1582 ft. depth
Height: Above/Below Surface ______ ft.
Weight ______ lb./ft.
Drive Shoe? ☐ Yes ☐ No

11. SCREEN:
Type: ______ Diam.: ______
Slot/Gauge: ______ Length: ______
Set Between: ______ ft. and ______ ft.
______ ft. and ______ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☐ No

12. STATIC WATER LEVEL ______ ft. below land surface after 24 hours

13. PUMPING LEVEL Below Land Surface.
______ ft. after ______ hrs. Pumping ______ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: ______

14. WATER QUALITY
Chemical Analysis ☐ Yes ☐ No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

15. ARTIFICIAL FILTER (filter pack) ☐ Yes ☐ No
Installed from ______ ft. to ______ ft.
Effective size ______ Uniformity Coefficient ______

16. WELL GROUTED? ☐ Yes ☐ No
☐ Neat Cement ☐ Bentonite ☐ Bentonite/Cement ☐ Other ______
Depth: From ______ ft. to ______ ft.

17. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
Type ______
Well Disinfected ☐ Yes ☐ No Type: ______ Amount: ______

18. PUMP: Date installed: ______ Not installed ☐
Mfr. Name: ______ Model No.: ______
H.P. ______ Volts ______ Length of drop pipe ______ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

19. WELL DRILLER: **CERT. NO.:**
Address: (Print) Level: A B C D (circle one)
Telephone No.: Fax No.:

20. WATER WELL DRILLER'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Signed: ______ Date: ______
Well Driller

If D Level Driller, provide supervising driller's name:

DHEC 1903 (03/2004)

COPY 1 MAIL TO SCDHEC, COPY 2 TO WELL OWNER, COPY 3 TO WELL DRILLER

GEOLOGIC LOG

Leggette, Brashears & Graham, Inc.
600 East Crescent Avenue, Suite 200
Upper Saddle River, New Jersey 07458
www.lbgweb.com

CLIENT: FOX ENGINEERING ASSOCIATES, INC. and MAGURO ENTERPRISES, LLC	
WELL NO.: TW-1	
PAGE: 1 **of** 11 **PAGES**	
SITE LOCATION: Moncks Corner, South Carolina	**SCREEN TYPE:** SS Wire-Wrap **DIAMETER:** 14-inch
	SLOT NO.: 40-slot **SETTING:** 1,582-1,597' / 1,612-1,682'
DATE COMPLETED: December 1, 2014	**SAND PACK SIZE:** #2
DRILLING COMPANY: Layne Christensen, Co.	**SETTING:** 1,530 – 1,685 ft. bg.
	CASING TYPE: Steel **DIAMETER:** 26" / 20" / 14"
DRILLING METHOD: Mud Rotary	**SETTING:** 0-200 ft.bg. / 3-1,582 ft.bg. / 1,532-1,582 ft.bg
SAMPLING METHOD: Wash	**SEAL TYPE:** Cement grout
OBSERVER: M. Iannacone	**SETTING:** 0- 1,570 ft. bg.
REFERENCE POINT (RP): Grade	**BACKFILL TYPE:** NA
ELEVATION OF RP: NA	**STATIC WATER LEVEL:** 54 ft btoc **DATE:** 11/1/2014
SURFACE COMPLETION: Stick-up	**DEVELOPMENT METHOD:** Airlift
	DURATION: ~ 30 hours **ESTIMATED YIELD:** 2,400+ gpm*

COMMENTS: 3-foot sump at bottom, Screen Blank = 1597-1612 ft.bg. *estimated yield based on 72-hour test

ABBREVIATIONS: W = wash f = fine m = medium c = coarse ft.bg. = feet below grade EOB = End of Boring SS = Stainless Steel ft btoc = feet below top of casing gpm = gallons per minute

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
0	10	W	NA	NA	SAND, f; some silt; mottled; dark yellowish brown (10YR/4/4) and reddish brown (5YR/4/4).
10	20	W	NA	NA	SAND, m; some f sand; trace clay lenses; light yellowish brown (2.5Y 6/4).
20	30	W	NA	NA	SAND, f-m; little c sand; trace silt and clay; little mottling; light yellowish brown (2.5Y 6/4).
30	40	W	NA	NA	SAND, f; with silt; some mottling (reddish brown (5YR/4/4); light brownish gray (2.5Y 6/2).
40	50	W	NA	NA	CLAY; some silt; light gray (2.5Y 7/1).
50	60	W	NA	NA	CLAY; with silt; light gray (2.5Y 7/1).
60	70	W	NA	NA	CLAY; with silt; light gray (2.5Y 7/1).
70	80	W	NA	NA	CLAY; gray (2.5Y 6/1).
80	90	W	NA	NA	CLAY; gray (2.5Y 6/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
90	100	W	NA	NA	CLAY; with silt; light brownish gray (2.5Y/6/2).
100	110	W	NA	NA	SAND, f; some silt; few f sand nodules; trace m sand; light brownish gray (2.5Y/6/2).
110	120	W	NA	NA	SAND, f; little silt; loose; grayish brown (2.5Y 5/2).
120	130	W	NA	NA	SILT; with f sand; trace clay; grayish brown (2.5Y 5/2).
130	140	W	NA	NA	SILT; little f sand; little clay; grayish brown (2.5Y 5/2).
140	150	W	NA	NA	SILT; with clay little f sand; grayish brown (2.5Y 5/2).
150	160	W	NA	NA	SILT; with clay little f sand; grayish brown (2.5Y 5/2).
160	170	W	NA	NA	SAND, f; some silt; little m sand; trace f gravel and clay lenses; grayish brown (2.5Y 5/2).
170	180	W	NA	NA	SILT; with f sand; grayish brown (2.5Y 5/2).
180	190	W	NA	NA	SAND, f; some silt; few clay lenses; grayish brown (2.5Y 5/2).
190	200	W	NA	NA	SAND, f; some silt; trace clay lenses; grayish brown (2.5Y 5/2).
200	220	W	NA	NA	SAND, fmc, little silt; trace rounded f gravel, trace clay; light brownish gray (2.5Y 6/2).
220	240	W	NA	NA	SAND, f-m; trace c sand and shell fragments; dark gray (2.5Y 4/1).
240	260	W	NA	NA	SAND, f-m; few shell fragments and c sand; gray (2.5Y 6/1).
260	280	W	NA	NA	SAND, f; trace m sand and shell fragments; gray (10YR 5/1).
280	300	W	NA	NA	SAND, f; some m sand; trace shell fragments; gray (10YR 5/1).
300	320	W	NA	NA	SAND, m; some f sand; little c sand and shell fragments; gray (10YR 5/1).
320	340	W	NA	NA	SAND, m; few shell fragments; little f and c sand; gray (2.5YR 5/1).
340	360	W	NA	NA	SAND, m; few shell fragments; little f and c sand; dark gray (2.5YR 4/1).
360	380	W	NA	NA	SAND, m; some shell fragments; little f sand; trace c sand; dark gray (2.5YR 4/1).
380	400	W	NA	NA	SAND, m; little f sand; trace shell fragments and c sand; dark gray (2.5YR 4/1).
400	420	W	NA	NA	SAND, m; little f and c sand; little shell fragments; trace subrounded gravel and silt; dark gray (2.5YR 4/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
420	440	W	NA	NA	SAND, m; little c sand; few shell fragments; trace silt; dark gray (2.5YR 4/1).
440	460	W	NA	NA	SAND, c; some m sand; little f sand and shell fragments; trace silt and clay; very dark gray (5Y 3/1).
460	480	W	NA	NA	SAND, c; with silt; some shell fragments and/or subrounded, f gravel; little f-m sand; very dark gray (5Y 3/1).
480	500	W	NA	NA	SAND, f-m; with silt; trace c sand and clay; trace shell fragments; very dark gray (5Y 3/1).
500	520	W	NA	NA	SAND, f-m; with silt; little c sand; trace subrounded gravel and clay; very dark gray (5Y 3/1).
520	540	W	NA	NA	SILT; some f-m sand; trace c sand; very dark greenish gray (10Y 3/2).
540	560	W	NA	NA	SAND, f-m-c; with silt; some shell fragments and/or f gravel; very dark greenish gray (10Y 3/2).
560	580	W	NA	NA	SILT; some subangular to subrounded f gravel and shell fragments; little f-m sand; very dark greenish gray (10Y 3/2).
580	600	W	NA	NA	SILT; some f-m-c sand; trace subangular f gravel; trace clay; trace dry vf sand/silt nodules; very dark greenish gray (10Y 3/2).
600	620	W	NA	NA	SILT; some f sand; little m sand; trace c sand; very dark greenish gray (10Y 3/2).
620	640	W	NA	NA	SAND, f; with silt; trace m sand and shell fragments; very dark greenish gray (10Y 3/2).
640	660	W	NA	NA	SAND, f; with silt; some m sand; little c sand and shell fragments; very dark greenish gray (10Y 3/2).
660	680	W	NA	NA	SAND, f-m; with silt; few shell fragments; trace c sand; very dark greenish gray (10Y 3/2).
680	700	W	NA	NA	SAND, f-m; with silt; few shell fragments; trace c sand; very dark greenish gray (10Y 3/2).
700	720	W	NA	NA	SAND, f-m; little silt and shell fragments; trace c sand; very dark greenish gray (10Y 3/2).
720	740	W	NA	NA	SAND, f; some m sand; little silt; very dark greenish gray (10Y 3/2).
740	760	W	NA	NA	SAND, f; some m sand; few shell fragments; very dark gray (5Y 3/1).
760	780	W	NA	NA	SAND, f; trace shell and mica fragments; dark gray (2.5YR 4/1).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
780	800	W	NA	NA	SAND, f; little silt and m sand; trace shell fragments; dark gray (2.5YR 4/1).
800	820	W	NA	NA	SAND, f; some black f-m flakes (biotite); little m sand; few shell fragments ; little m sand; trace silt; dark gray (2.5YR 4/1).
820	840	W	NA	NA	SAND, f; some black f-m flakes (biotite); little m sand; few shell fragments ; little m sand; trace silt; dark gray (2.5YR 4/1).
840	860	W	NA	NA	SAND, f; some black and white f-m flakes (biotite, muscovite) and vf sand; little m sand; few shell fragments ; little m sand; trace silt; dark gray (2.5YR 4/1).
860	880	W	NA	NA	SAND, f; some black and white f-m flakes (biotite, muscovite) and vf sand; little m sand; few shell fragments; little m sand and silt; dark gray (2.5YR 4/1).
880	900	W	NA	NA	SAND, f; some m sand; little silt; trace shell fragments and/or mica; dark gray (2.5YR 4/1).
900	920	W	NA	NA	SAND, f; some m sand; trace silt and mica flakes; dark gray (2.5YR 4/1).
920	940	W	NA	NA	SAND, f; some m sand; trace silt and mica flakes; dark gray (2.5YR 4/1).
940	960	W	NA	NA	SAND, f; some silt; little m sand; dark gray (2.5YR 4/1).
960	980	W	NA	NA	SAND, f; with silt; little m sand and trace shell fragments; dark gray (2.5YR 4/1).
980	1,000	W	NA	NA	SAND, f; with silt; little m sand; trace shell fragments; dark gray (2.5YR 4/1).
1,000	1,010	W	NA	NA	SAND, f; with silt; trace m sand; and shell fragments; dark gray (2.5YR 4/1).
1,010	1,020	W	NA	NA	SAND, f; some silt and m sand; trace clay lenses; dark gray (2.5YR 4/1).
1,020	1,030	W	NA	NA	SAND, f; with silt; some m sand; trace clay; dark gray (2.5YR 4/1).
1,030	1,040	W	NA	NA	SILT; some f sand; little m sand; trace shell fragments; trace soft, f sand nodules; dark gray (2.5YR 4/1).
1,040	1,050	W	NA	NA	SILT; with some f sand; little m sand; trace shell fragments; dark gray (2.5YR 4/1).
1,050	1,060	W	NA	NA	SAND, f-m; with silt; trace shell fragments; dark gray (2.5YR 4/1).
1,060	1,070	W	NA	NA	SAND, f-m; with silt; little c sand and shell fragments; dark gray (2.5YR 4/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,070	1,080	W	NA	NA	SAND, f; some shell fragments; little m sand; trace silt; dark gray (2.5YR 4/1).
1,080	1,090	W	NA	NA	SAND, f-m; with silt; few to some shell fragments; little clay; dark gray (2.5YR 4/1).
1,090	1,100	W	NA	NA	SILT; with f sand; little m sand and shell fragments; trace clay; dark gray (2.5YR 4/1).
1,100	1,105	W	NA	NA	SILT; some f sand; little m sand and shell fragments; trace clay; dark gray (2.5YR 4/1).
1,105	1,110	W	NA	NA	SILT; little f-m sand and shell fragments; trace c sand and clay; dark gray (2.5YR 4/1).
1,110	1,115	W	NA	NA	SILT; little f-m sand; trace shell fragments, c sand, and clay; dark gray (2.5YR 4/1).
1,115	1,120	W	NA	NA	SAND, f-m; with silt; little shell fragments; trace clay; dark gray (2.5YR 4/1).
1,120	1,125	W	NA	NA	SILT; with f sand; little m sand; trace c sand and shell fragments; trace clay; dark gray (2.5YR 4/1).
1,125	1,130	W	NA	NA	SILT; with f-m sand; little shell fragments and clay; dark gray (2.5YR 4/1).
1,130	1,135	W	NA	NA	SILT; with f sand; little m sand and shell fragments; little clay; dark gray (2.5YR 4/1).
1,135	1,140	W	NA	NA	SILT; little f-m sand and shell fragments; little clay; dark gray (2.5YR 4/1).
1,140	1,145	W	NA	NA	SAND, f; with silt; dark gray (2.5YR 4/1).
1,145	1,150	W	NA	NA	SAND, f; with silt; trace m-c sand and shell fragments; dark gray (2.5YR 4/1).
1,150	1,155	W	NA	NA	SAND, f; with silt; some m sand; trace shell fragments; dark gray (2.5YR 4/1).
1,155	1,160	W	NA	NA	SAND, f; with silt; trace m sand and shell fragments; dark gray (2.5YR 4/1).
1,160	1,165	W	NA	NA	SILT; with f-m sand; trace clay lenses and shell fragments; dark gray (2.5YR 4/1).
1,165	1,170	W	NA	NA	SAND; f; little m sand and silt; dark gray (2.5YR 4/1).
1,170	1,175	W	NA	NA	SAND, f; with silt; little m sand; trace c sand and clay lenses; dark gray (2.5YR 4/1).
1,175	1,180	W	NA	NA	SAND, f; some silt; some m sand; little c sand; trace shell fragments; SAND, f-m-c; some silt and shell fragments; dark gray (2.5YR 4/1).
1,180	1,185	W	NA	NA	SAND, f-m-c; some silt and shell fragments; dark gray (2.5YR 4/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,185	1,190	W	NA	NA	SAND, f-m-c; some silt and shell fragments; dark gray (2.5YR 4/1).
1,190	1,195	W	NA	NA	SAND; m-c-f; some silt; some shell fragments; dark gray (2.5YR 4/1).
1,195	1,200	W	NA	NA	SAND, f-m; little c sand and silt; trace shell fragments; dark gray (2.5YR 4/1).
1,200	1,205	W	NA	NA	SAND, f-m; some silt; little c sand and shell fragments; dark gray (2.5YR 4/1).
1,205	1,210	W	NA	NA	SAND, m-f-c; some silt; little shell fragments; dark gray (2.5YR 4/1).
1,210	1,215	W	NA	NA	SAND, m-c-f; some silt; little shell fragments; dark gray (2.5YR 4/1).
1,215	1,220	W	NA	NA	SAND, m-f; some silt; little c sand and shell fragments; dark gray (2.5YR 4/1).
1,220	1,225	W	NA	NA	SAND, m; with silt; some f sand and shell fragments; trace clay lenses; dark gray (2.5YR 4/1).
1,225	1,230	W	NA	NA	SAND, m; with silt; some f sand and shell fragments; trace clay lenses; dark gray (2.5YR 4/1).
1,230	1,235	W	NA	NA	SAND, c; some m-f sand and silt; trace f gravel and/or shell fragments; dark gray (2.5YR 4/1).
1,235	1,240	W	NA	NA	SAND, c, with shell fragments; some silt; little f-m sand; trace angular f gravel; dark gray (2.5YR 4/1).
1,240	1,245	W	NA	NA	SAND, c, with shell fragments; some silt; little f-m sand; trace angular f gravel and clay lenses; dark gray (2.5YR 4/1).
1,245	1,250	W	NA	NA	SAND, c, with shell fragments; some silt and m sand; little f sand; trace angular f gravel and clay lenses; dark gray (2.5YR 4/1).
1,250	1,255	W	NA	NA	SAND, cm, with shell fragments; some silt; little f sand; trace angular f gravel and clay lenses; dark gray (2.5YR 4/1).
1,255	1,260	W	NA	NA	SAND, m; some silt; little c and f sand/shell fragments; trace clay lenses; dark gray (2.5YR 4/1).
1,260	1,265	W	NA	NA	SAND, m; with silt; little f sand; trace c sand and shell fragments; trace clay; dark gray (2.5YR 4/1).
1,265	1,270	W	NA	NA	SAND, m; with silt; little f sand; trace c sand and shell fragments; trace clay; dark gray (2.5YR 4/1).
1,270	1,275	W	NA	NA	SAND, m; with silt; little f sand; trace c sand and shell fragments; trace clay; dark gray (2.5YR 4/1).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,275	1,280	W	NA	NA	SAND, m; with silt; little f sand and shell fragments; trace c sand; dark gray (2.5YR 4/1).
1,280	1,285	W	NA	NA	SAND, f-m; with silt; some shell fragments; trace c sand; dark gray (2.5YR 4/1).
1,285	1,290	W	NA	NA	SAND, vf-f; some silt; trace c sand and shell fragments; dark gray (2.5YR 4/1).
1,290	1,295	W	NA	NA	SAND, vf-f; some silt; trace c sand and shell fragments; dark gray (2.5YR 4/1).
1,295	1,300	W	NA	NA	SAND, vf-f; some silt; trace c sand and shell fragments; dark gray (2.5YR 4/1).
1,300	1,305	W	NA	NA	SAND, vf-f; some silt; trace c sand and shell fragments; dark gray (2.5YR 4/1).
1,305	1,310	W	NA	NA	SAND, vf-f; some silt; trace c sand and shell fragments; dark gray (2.5YR 4/1).
1,310	1,315	W	NA	NA	SAND, vf-f; some silt; trace c sand and shell fragments; dark gray (2.5YR 4/1).
1,315	1,320	W	NA	NA	SAND, vf-f; little silt; dark gray (2.5YR 4/1).
1,320	1,325	W	NA	NA	SAND, vf-f; little silt; dark gray (2.5YR 4/1).
1,325	1,330	W	NA	NA	SAND, vf-f; little silt; dark gray (2.5YR 4/1).
1,330	1,335	W	NA	NA	SAND, vf-f; trace silt; dark gray (2.5YR 4/1).
1,335	1,340	W	NA	NA	SAND, vf-f; little silt; dark gray (2.5YR 4/1).
1,340	1,345	W	NA	NA	SAND, vf-f; dark gray (2.5YR 4/1).
1,345	1,350	W	NA	NA	SAND, vf-f; trace silt; dark gray (2.5YR 4/1).
1,350	1,355	W	NA	NA	SAND, vf-f; dark gray (2.5YR 4/1).
1,355	1,360	W	NA	NA	SAND, vf-f; dark gray (2.5YR 4/1).
1,360	1,365	W	NA	NA	SAND, m-c; with silt; little f sand and shell fragments; trace rounded f gravel; SAND, vf-f; little silt; dark gray (2.5YR 4/1).
1,365	1,370	W	NA	NA	SAND, m-c; with silt; little f sand and shell fragments; trace rounded f gravel; SAND, vf-f; little silt; dark gray (2.5YR 4/1).
1,370	1,375	W	NA	NA	SAND, m-c; with silt; little f sand and shell fragments; trace rounded f gravel; SAND, vf-f; little silt; dark gray (2.5YR 4/1).
1,375	1,380	W	NA	NA	SAND, m-c; with silt; little f sand and shell fragments; trace rounded f gravel; SAND, vf-f; little silt; dark gray (2.5YR 4/1).
1,380	1,385	W	NA	NA	SAND, c-m; with silt; some shell fragments; little f sand; dark gray (2.5YR 4/1).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,385	1,390	W	NA	NA	SAND, m-c; with silt; some shell fragments; little f sand and clay lenses; dark gray (2.5YR 4/1).
1,390	1,395	W	NA	NA	SILT; with m-f sand; some shell fragments; trace c sand and clay; dark gray (2.5YR 4/1).
1,395	1,400	W	NA	NA	SAND, c; with silt; some shell fragments and m sand; little f sand and clay; dark gray (2.5YR 4/1).
1,400	1,405	W	NA	NA	SILT; with m-c sand and shell fragments; dark gray (2.5YR 4/1).
1,405	1,410	W	NA	NA	SILT; some m-f sand and shell fragments; little c sand; trace rounded f gravel; dark gray (2.5YR 4/1).
1,410	1,415	W	NA	NA	SILT; some m sand and shell fragments; trace f-c sand; dark gray (2.5YR 4/1).
1,415	1,420	W	NA	NA	SAND, m-c; with silt; some shell fragments; trace f sand and clay lenses; dark gray (2.5YR 4/1).
1,420	1,425	W	NA	NA	SAND, f-m-c; with silt; some shell fragments; little clay; dark gray (2.5YR 4/1).
1,425	1,430	W	NA	NA	SILT; with f-m sand; some shell fragments; trace c sand and clay lenses; dark gray (2.5YR 4/1).
1,430	1,435	W	NA	NA	SAND, m-c-f; with shell fragments and silt; little clay lenses; dark gray (2.5YR 4/1).
1,435	1,440	W	NA	NA	SAND, m-c-f; with shell fragments and silt; little clay lenses; dark gray (2.5YR 4/1).
1,440	1,445	W	NA	NA	SAND, m-c-f; with shell fragments; some silt; little clay lenses; dark gray (2.5YR 4/1).
1,445	1,450	W	NA	NA	SAND, m-c-f; with shell fragments; some silt; little clay lenses; dark gray (2.5YR 4/1).
1,450	1,455	W	NA	NA	SAND, f-m-c; with shell fragments; some silt; little clay lenses; dark gray (2.5YR 4/1).
1,455	1,460	W	NA	NA	SILT; with f-m sand and shell fragments; trace clay lenses and c sand; dark gray (2.5YR 4/1).
1,460	1,465	W	NA	NA	SILT; with f-m sand; some shell fragments; trace clay lenses; dark gray (2.5YR 4/1).
1,465	1,470	W	NA	NA	SILT; with f- m sand and shell fragments; little c sand and clay lenses; dark gray (2.5YR 4/1).
1,470	1,475	W	NA	NA	SILT; some f-m-c sand and shell fragments; little clay lenses; dark gray (2.5YR 4/1).
1,475	1,480	W	NA	NA	SILT; some f-m-c sand and shell fragments; trace clay lenses; dark gray (2.5YR 4/1).
1,480	1,485	W	NA	NA	SILT; some f-m-c sand and shell fragments; trace clay lenses; dark gray (2.5YR 4/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,485	1,490	W	NA	NA	SILT; with f sand; some m sand and shell fragments; little c sand and clay lenses; dark gray (2.5YR 4/1).
1,490	1,495	W	NA	NA	SAND, f; with silt; little m sand and shell fragments; trace c sand; dark gray (2.5YR 4/1).
1,495	1,500	W	NA	NA	SAND, f; with silt; little m sand and shell fragments; trace c sand; dark gray (2.5YR 4/1).
1,500	1,505	W	NA	NA	SILT; with f-m sand; some shell fragments; trace c sand; dark gray (2.5YR 4/1).
1,505	1,510	W	NA	NA	SILT; with f-m sand; some shell fragments; trace c sand; dark gray (2.5YR 4/1).
1,510	1,515	W	NA	NA	SILT; with f-m sand and shell fragments; little clay lenses; trace c sand; dark gray (2.5YR 4/1).
1,515	1,520	W	NA	NA	SILT; with f-m sand and shell fragments; little clay lenses; trace c sand; dark gray (2.5YR 4/1).
1,520	1,525	W	NA	NA	SILT: some clay; little m-c sand and shell fragments; dark gray (2.5YR 4/1).
1,525	1,530	W	NA	NA	SILT; some clay; some m-c sand; little f sand and shell fragments; dark gray (2.5YR 4/1).
1,530	1,535	W	NA	NA	SILT; with f-m-c sand and shell fragments; dark gray (2.5YR 4/1).
1,535	1,540	W	NA	NA	SILT; little f-m sand, clay, and shell fragments; trace c sand; dark gray (2.5YR 4/1).
1,540	1,545	W	NA	NA	SILT; little f-m sand, clay, and shell fragments; trace c sand; dark gray (2.5YR 4/1).
1,545	1,550	W	NA	NA	SILT; with f-m sand and shell fragments; little c sand and clay; dark gray (2.5YR 4/1).
1,550	1,555	W	NA	NA	SAND, vf-f; little silt; dark gray (2.5YR 4/1).
1,555	1,560	W	NA	NA	SAND (vf-f); little silt; dark gray (2.5YR 4/1).
1,560	1,565	W	NA	NA	SILT; some f-m-c sand; little clay lenses and shell fragments; dark gray (2.5YR 4/1).
1,565	1,570	W	NA	NA	SILT; some f-m-c sand; little clay lenses and shell fragments; dark gray (2.5YR 4/1).
1,570	1,575	W	NA	NA	SAND, f; with silt; little shell fragments; m sand; and clay lenses; dark gray (2.5YR 4/1).
1,575	1,580	W	NA	NA	SAND, f; with silt; little shell fragments; m sand; and clay lenses; dark gray (2.5YR 4/1).
1,580	1,585	W	NA	NA	SAND, m; some f sand; little shell fragments and silt; trace c sand; dark gray (2.5YR 4/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,585	1,590	W	NA	NA	SAND, m; some f sand; little shell fragments and silt; trace c sand; dark gray (2.5YR 4/1).
1,590	1,595	W	NA	NA	SAND, m; some f sand; little shell fragments and silt; trace c sand; dark gray (2.5YR 4/1).
1,595	1,600	W	NA	NA	SAND, m-f; little shell fragments and silt; trace c sand; dark gray (2.5YR 4/1).
1,600	1,605	W	NA	NA	SAND, f-m-c; little shell fragments and silt; dark gray (2.5YR 4/1).
1,605	1,610	W	NA	NA	SAND, f-m-c; little shell fragments; trace silt; dark gray (2.5YR 4/1).
1,610	1,615	W	NA	NA	SAND, m-f-c; little shell fragments; trace silt; dark gray (2.5YR 4/1).
1,615	1,620	W	NA	NA	SAND, m-f-c; little shell fragments; trace silt; dark gray (2.5YR 4/1).
1,620	1,625	W	NA	NA	SAND, m-f; little shell fragments; dark gray (2.5YR 4/1).
1,625	1,630	W	NA	NA	SAND, m-f-c; little shell fragments; dark gray (2.5YR 4/1).
1,630	1,635	W	NA	NA	SAND, m-f-c; little shell fragments; dark gray (2.5YR 4/1).
1,635	1,640	W	NA	NA	SAND, m-f-c; little shell fragments; dark gray (2.5YR 4/1).
1,640	1,645	W	NA	NA	SAND, m-f-c; little shell fragments; dark gray (2.5YR 4/1).
1,645	1,650	W	NA	NA	SAND, m-f-c; trace shell fragments; dark gray (2.5YR 4/1).
1,650	1,655	W	NA	NA	SAND, m-f-c; trace shell fragments; dark gray (2.5YR 4/1).
1,655	1,660	W	NA	NA	SAND, m-f-c; trace shell fragments; dark gray (2.5YR 4/1).
1,660	1,665	W	NA	NA	SAND, m-c-f; trace shell fragments; dark gray (2.5YR 4/1).
1,665	1,670	W	NA	NA	SAND, m-c; little f sand; trace shell fragments; dark gray (2.5YR 4/1).
1,670	1,675	W	NA	NA	SAND, m-c; little shell fragments; trace f sand; dark gray (2.5YR 4/1).
1,675	1,680	W	NA	NA	SAND, m-c; some f sand; little shell fragments; dark gray (2.5YR 4/1).
1,680	1,685	W	NA	NA	SAND, c; some m sand; trace shell fragments and rounded f gravel; dark gray (2.5YR 4/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,685	1,690	W	NA	NA	SILT; some clay; little sand and rounded f gravel; dark gray (2.5YR 4/1).
1,690	1,695	W	NA	NA	SILT; some clay; little sand and rounded f gravel; dark gray (2.5YR 4/1).
1,695	1,700	W	NA	NA	CLAY: with silt; little sand and shell fragments; dark gray (2.5YR 4/1).
1,700	1,705	W	NA	NA	CLAY: with silt; little sand and shell fragments; dark gray (2.5YR 4/1).
					EOB: 1707 ft.

DHEC
PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 898-4300

1. WELL OWNER INFORMATION:
Name: Maguro Enterprises, LLC
(last) (first)
Address: 1669 Garrott Avenue
City: Moncks Corner State: SC Zip: 29461
Telephone: Work: Home:

2. LOCATION OF WELL: **COUNTY:** Berkeley
Name: MW-1
Street Address: 3203 HWY 52
City: Moncks Corner Zip: 29461
Latitude: 33.067618 Longitude: -80.037917

3. PUBLIC SYSTEM NAME: **PUBLIC SYSTEM NUMBER:**
Not applicable

4. ABANDONMENT: ☐ Yes ☑ No
Give Details Below
Grouted Depth: from ______ ft. to ______ ft.

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
See attached Geologic Log		

*Indicate Water Bearing Zones
(Use a 2nd sheet if needed)

5. REMARKS:

6. TYPE: ☑ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☐ Other

7. PERMIT NUMBER:

8. USE:
☐ Residential ☐ Public Supply ☐ Process
☐ Irrigation ☐ Air Conditioning ☐ Emergency
☐ Test Well ☑ Monitor Well ☐ Replacement

9. WELL DEPTH (completed) Date Started: 9/5/2014
1646 ft. Date Completed: 11/2/2014

10. CASING: ☐ Threaded ☑ Welded
Diam.: 4" and 10"
Type: ☐ PVC ☐ Galvanized ☑ Steel ☐ Other
10" in. to 1555 ft. depth
4" in. to 1605 ft. depth
Height: Above/Below
Surface ______ ft.
Weight ______ lb./ft.
Drive Shoe? ☐ Yes ☐ No

11. SCREEN:
Type: ______ Diam.: ______
Slot/Gauge: ______ Length: ______
Set Between: ______ ft. and ______ ft.
______ ft. and ______ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☐ No

12. STATIC WATER LEVEL ______ ft. below land surface after 24 hours

13. PUMPING LEVEL Below Land Surface.
______ ft. after ______ hrs. Pumping ______ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: ______

14. WATER QUALITY
Chemical Analysis ☐ Yes ☐ No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

15. ARTIFICIAL FILTER (filter pack) ☐ Yes ☐ No
Installed from ______ ft. to ______ ft.
Effective size ______ Uniformity Coefficient ______

16. WELL GROUTED? ☐ Yes ☐ No
☐ Neat Cement ☐ Bentonite ☐ Bentonite/Cement ☐ Other ______
Depth: From ______ ft. to ______ ft.

17. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ______ ft. ______ direction
Type ______
Well Disinfected ☐ Yes ☐ No Type: ______ Amount: ______

18. PUMP: Date installed: ______ Not installed ☐
Mfr. Name: ______ Model No.: ______
H.P. ______ Volts ______ Length of drop pipe ______ ft. Capacity ______ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine
☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

19. WELL DRILLER: **CERT. NO.:**
Address: (Print) Level: A B C D (circle one)
Telephone No.: Fax No.:

20. WATER WELL DRILLER'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Signed: ______ Date: ______
Well Driller

If D Level Driller, provide supervising driller's name:

DHEC 1903 (03/2004)

COPY 1 MAIL TO SCDHEC, COPY 2 TO WELL OWNER, COPY 3 TO WELL DRILLER

GEOLOGIC LOG

Leggette, Brashears & Graham, Inc.
600 East Crescent Avenue, Suite 200
Upper Saddle River, New Jersey 07458
www.lbgweb.com

CLIENT: FOX ENGINEERING ASSOCIATES, INC. and MAGURO ENTERPRISES, LLC

WELL NO.: MW-1

SITE LOCATION: Moncks Corner, South Carolina	**SCREEN TYPE:** SS Wire-Wrap **DIAMETER:** 4-inch
	SLOT NO.: 20-slot **SETTING:** 1,605-1,645 ft.bg.
DATE COMPLETED: 11/2/2014	**SAND PACK SIZE:**
DRILLING COMPANY: Layne Christensen, Co.	**SETTING:** 1,555 – 1,646 ft. bg.
	CASING TYPE: Steel **DIAMETER:** 10-inch / 4-inch
DRILLING METHOD: Mud Rotary	**SETTING:** 0-200 ft.bg. / 3-1,605 ft.bg.
SAMPLING METHOD: Wash	**SEAL TYPE:** Cement grout
OBSERVER: M. Iannacone	**SETTING:** 0-1,555 ft. bg.
REFERENCE POINT (RP): Grade	**BACKFILL TYPE:** NA
ELEVATION OF RP: NA	**STATIC WATER LEVEL:** 54 ft btoc **DATE:** 11/1/2014
SURFACE COMPLETION: Stick-Up	**DEVELOPMENT METHOD:** Airlift
	DURATION: ~18 hours **ESTIMATED YIELD:** 100 gpm*

COMMENTS: *estimated yield based on airlift development

ABBREVIATIONS: W = wash f = fine m = medium c = coarse ft.bg. = feet below grade EOB = End of Boring SS = Stainless Steel ft btoc = feet below top of casing gpm = gallons per minute

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
0	10	W	NA	NA	SILT; with fine sand; mottled; dark yellowish brown (10YR 4/4) and reddish brown (5YR 4/4).
10	20	W	NA	NA	SILT; with fine sand; mottled; dark yellowish brown (10YR 4/4) and reddish brown (5YR 4/4).
20	30	W	NA	NA	SILT; with fine sand; mottled; dark yellowish brown (10YR 4/4) and reddish brown (5YR 4/4).
30	40	W	NA	NA	SILT; with fine sand; mottled; dark yellowish brown (10YR 4/4) and reddish brown (5YR 4/4).
40	50	W	NA	NA	CLAY; little silt; mottled, dark yellowish brown (10YR 4/4) and reddish brown (5YR 4/4); light brownish gray (2.5Y 6/2).
50	60	W	NA	NA	CLAY; little silt; mottled, dark yellowish brown (10YR 4/4); light brownish gray (2.5Y 6/2).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
60	70	W	NA	NA	CLAY; little silt; mottled, dark yellowish brown (10YR 4/4); light brownish gray (2.5Y 6/2).
70	80	W	NA	NA	CLAY; little silt; trace mottling; light brownish gray (2.5Y 6/2).
80	90	W	NA	NA	CLAY; with silt; light brownish gray (2.5Y 6/2).
90	100	W	NA	NA	CLAY; with silt; light brownish gray (2.5Y 6/2).
100	110	W	NA	NA	SILT; with clay; light brownish gray (2.5Y 6/2).
110	120	W	NA	NA	SILT; little f sand and clay; light brownish gray (2.5Y 6/2).
120	130	W	NA	NA	SILT; little f sand and clay; light brownish gray (2.5Y 6/2).
130	140	W	NA	NA	SILT; little f sand and clay; light brownish gray (2.5Y 6/2).
140	150	W	NA	NA	SILT; with f sand; little clay; light brownish gray (2.5Y 6/2).
150	160	W	NA	NA	SILT; with f sand; little clay; light brownish gray (2.5Y 6/2).
160	170	W	NA	NA	SILT; with f sand; little clay; light brownish gray (2.5Y 6/2).
170	180	W	NA	NA	SILT; with fine sand; light brownish gray (2.5Y 6/2).
180	190	W	NA	NA	SILT; with f sand; cemented; light gray (10YR 7/1).
190	200	W	NA	NA	SAND, f; with “limestone”; some silt; cemented; light gray (10YR 7/1).
200	210	W	NA	NA	SAND, f; with limestone fragments; some silt; cemented; light gray (10YR 7/1).
210	230	W	NA	NA	SAND, f; mottling (rust/reddish coloring); gray (10YR 7/1).
230	250	W	NA	NA	LIMESTONE FRAGMENTS; with shells; light gray (5YR 7/1).
250	270	W	NA	NA	SHELLS; with limestone fragments; light gray (5YR 7/1).
270	290	W	NA	NA	SHELLS; with fine sand and silt (dark gray (10YR 4/1);
290	310	W	NA	NA	LIMESTONE FRAGMENTS; with shells and shell fragments; light gray (5YR 7/1).
310	330	W	NA	NA	LIMESTONE FRAGMENTS; with shells and shell fragments; light gray (5YR 7/1).
330	350	W	NA	NA	SAND, f; little silt; few angular, m gravel; trace limestone fragments; light gray (5YR 7/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
350	370	W	NA	NA	SAND, f; little silt; few angular, m gravel; trace limestone fragments; light gray (5YR 7/1).
370	390	W	NA	NA	SAND, f; some silt; trace m sand; dark greenish gray (10Y 3/1).
390	410	W	NA	NA	SAND, f; some silt; trace m sand; dark greenish gray (10Y 3/1).
410	430	W	NA	NA	SAND, f; some silt; trace m sand; dark greenish gray (10Y 3/1).
430	450	W	NA	NA	SAND, f; little silt; few light gray f sand nodules; trace m sand; dark greenish gray (10Y 3/1).
450	470	W	NA	NA	SAND, f; with silt; trace m sand; dark greenish gray (10Y 3/1).
470	490	W	NA	NA	SAND, f; with silt; trace clay; dark greenish gray (10Y 3/1).
490	510	W	NA	NA	SILT; with f sand; little m sand; trace clay; trace f-m shell fragments and/or gravel; dark greenish gray (10Y 3/1).
510	530	W	NA	NA	SILT; with f sand; little m sand; trace clay; trace f-m shell fragments and/or gravel; dark greenish gray (10Y 3/1).
530	550	W	NA	NA	SILT; with f sand; trace clay and trace f-m shell fragments and/or gravel; dark greenish gray (10Y 3/1).
550	570	W	NA	NA	SILT; with f sand; trace clay and trace f-m shell fragments and/or gravel; dark greenish gray (10Y 3/1).
570	590	W	NA	NA	SILT; with f sand; little clay; trace m-c sand; dark greenish gray (10Y 3/1).
590	610	W	NA	NA	SILT; with f sand; trace clay and m-c sand; dark greenish gray (10Y 3/1).
610	630	W	NA	NA	SILT; some f sand; little clay; trace m-c sand; dark greenish gray (10Y 3/1).
630	650	W	NA	NA	SILT; some f sand; little clay; trace m-c sand; dark greenish gray (10Y 3/1).
650	670	W	NA	NA	SILT; with f sand; some clay; trace shell fragments and m-c sand; dark greenish gray (10Y 3/1).
670	690	W	NA	NA	SILT; with f sand; some clay; trace shell fragments and m-c sand; dark greenish gray (10Y 3/1).
690	710	W	NA	NA	SILT; with f sand; some clay; trace shell fragments and m-c sand; dark greenish gray (10Y 3/1).

DEPTH (FEET) FROM	DEPTH (FEET) TO	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
710	730	W	NA	NA	SILT; some f sand; little clay; trace c sand; dark greenish gray (10Y 3/1).
730	750	W	NA	NA	SILT; some f sand; little clay; trace c sand; dark greenish gray (10Y 3/1).
750	770	W	NA	NA	SILT; with clay; few light gray clay lenses; little f sand; trace m gravel and shell fragments; dark greenish gray (10Y 3/1).
770	790	W	NA	NA	SILT; with clay; some f sand; trace shell fragments and/or f gravel; dark greenish gray (10Y 3/1).
790	810	W	NA	NA	SILT; with f sand; little clay; trace shell fragments; dark greenish gray (10Y 3/1).
810	830	W	NA	NA	SILT; with f sand; few shell fragments (up to 0.5"); trace clay; dark greenish gray (10Y 3/1).
830	850	W	NA	NA	SAND, f-m; with silt; little clay; trace f gravel and shell fragments; dark greenish gray (10Y 3/1).
850	870	W	NA	NA	CLAY; with silt and f sand; trace large shell fragments; dark greenish gray (10Y 3/1).
870	890	W	NA	NA	SILT; with clay; some f sand; few light gray, dry, f sand nodules; trace f gravel and m sand; dark greenish gray (10Y 3/1).
890	910	W	NA	NA	SILT; with clay; some f sand; few light gray, dry, f sand nodules; trace f gravel and m sand; dark greenish gray (10Y 3/1).
910	930	W	NA	NA	SILT; with clay; some f sand; trace f gravel and m sand; dark greenish gray (10Y 3/1).
930	950	W	NA	NA	SILT; with clay; some f sand; trace f gravel; dark greenish gray (10Y 3/1).
950	970	W	NA	NA	SILT; with clay; some f sand; trace f gravel; dark greenish gray (10Y 3/1).
970	990	W	NA	NA	SILT; with clay; some f sand; stiff; dark greenish gray (10Y 3/1).
990	1,010	W	NA	NA	SILT; with f sand; few clay layers; trace angular to subangular f gravel; dark greenish gray (10Y 3/1).
1,010	1,030	W	NA	NA	SILT; some f sand; few clay layers; trace angular f gravel; dark greenish gray (10Y 3/1).
1,030	1,050	W	NA	NA	SILT; with f sand; little gray clay; trace c sand and angular f gravel; dark greenish gray (10Y 3/1).
1,050	1,070	W	NA	NA	SILT; some f sand; little gray clay; trace friable angular gravel (limestone); dark greenish gray (10Y 3/1).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,070	1,090	W	NA	NA	SILT; some clay; little f sand; trace m sand and angular f gravel; dark greenish gray (10Y 3/1).
1,090	1,100	W	NA	NA	SILT; some clay; trace f-m sand; dark greenish gray (10Y 3/1).
1,100	1,130	W	NA	NA	SILT; some clay; trace c sand; dark greenish gray (10Y 3/1).
1,130	1,150	W	NA	NA	SAND, f; some silt; trace m sand; dark greenish gray (10Y 3/1).
1,150	1,170	W	NA	NA	SAND, f-m; trace silt and shell fragments; dark greenish gray (10Y 3/1).
1,170	1,190	W	NA	NA	SAND, m-c-f; with shell and mica fragments; little f angular to subrounded gravel; dark greenish gray (10Y 3/1).
1,190	1,210	W	NA	NA	SAND, m-c-f; with shell fragments and micas; little f angular to subrounded gravel; dark greenish gray (10Y 3/1).
1,210	1,230	W	NA	NA	SAND, f-m; little silt; trace clay; trace angular c sand; dark greenish gray (10Y 3/1).
1,230	1,235	W	NA	NA	SAND, f-m; some silt; little to some subrounded to rounded f gravel; dark greenish gray (10Y 3/1).
1,235	1,240	W	NA	NA	SAND, f-m; some silt; little to some subrounded to rounded f gravel; dark greenish gray (10Y 3/1).
1,240	1,245	W	NA	NA	SAND, f-m; little silt and clay lenses; little white, rounded f gravel; dark greenish gray (10Y 3/1).
1,245	1,250	W	NA	NA	SAND, f-m; little silt lenses; trace rounded gravel; dark greenish gray (10Y 3/1).
1,250	1,255	W	NA	NA	SAND, f-m; with silt; little c sand and subrounded f gravel; dark greenish gray (10Y 3/1).
1,255	1,260	W	NA	NA	SAND, f-m; with silt; little c sand and subrounded f gravel; dark greenish gray (10Y 3/1).
1,260	1,265	W	NA	NA	SAND, f; with silt; some m sand; little c sand; trace subrounded f gravel; dark greenish gray (10Y 3/1).
1,265	1,270	W	NA	NA	SAND, f-m; with silt; some c sand and subangular f gravel; dark greenish gray (10Y 3/1).
1,270	1,275	W	NA	NA	SAND, f-m; trace flat angular f-m gravel; well sorted; dark greenish gray (10Y 3/1).
1,275	1,280	W	NA	NA	SILT; some f sand; few hard f sand nodules; little clay; trace angular f-m gravel; dark greenish gray (10Y 3/1).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,280	1,285	W	NA	NA	SILT; some f sand and hard f sand nodules; little clay; trace angular f gravel; dark greenish gray (10Y 3/1).
1,285	1,290	W	NA	NA	SAND, f; with silt; few hard f sand nodules; little clay trace angular f gravel; dark greenish gray (10Y 3/1).
1,290	1,295	W	NA	NA	SAND, f; with silt; little m sand; little clay; trace angular f gravel; dark greenish gray (10Y 3/1).
1,295	1,300	W	NA	NA	SAND, f; with silt; little m sand; trace angular f gravel; dark greenish gray (10Y 3/1).
1,300	1,305	W	NA	NA	SILT; with f sand; some m-c sand and f sand nodules; trace c sand and subrounded to angular f gravel (quartz) and clay; dark greenish gray (10Y 3/1).
1,305	1,310	W	NA	NA	SILT; with f sand; some m-c sand and f sand nodules; trace c sand and subrounded to angular f gravel (quartz) and clay; dark greenish gray (10Y 3/1).
1,310	1,315	W	NA	NA	SILT; with f sand; some m-c sand and f sand nodules; trace f gravel and clay; dark greenish gray (10Y 3/1).
1,315	1,320	W	NA	NA	SILT; with f sand; some m-c sand; few f sand nodules; trace f gravel and clay; dark greenish gray (10Y 3/1).
1,320	1,325	W	NA	NA	SILT; with f sand; some m-c sand; trace f gravel and clay; dark greenish gray (10Y 3/1).
1,325	1,330	W	NA	NA	SILT; with f sand; some m-c sand; trace f gravel; dark greenish gray (10Y 3/1).
1,330	1,335	W	NA	NA	SILT; with clay; few dry, f sand lenses; trace clay lenses; dark greenish gray (10Y 3/1).
1,335	1,340	W	NA	NA	SILT; with clay; some dry, f sand lenses; dark greenish gray (10Y 3/1).
1,340	1,345	W	NA	NA	SILT; with clay; few dry, f sand lenses; dark greenish gray (10Y 3/1).
1,345	1,350	W	NA	NA	SILT; with clay; few dry, f sand lenses; dark greenish gray (10Y 3/1).
1,350	1,355	W	NA	NA	CLAY; some silt; few f-m shell fragments; trace clay lenses; dark greenish gray (10Y 3/1).
1,355	1,360	W	NA	NA	CLAY; some silt; few f-m shell fragments; trace clay lenses; dark greenish gray (10Y 3/1).
1,360	1,365	W	NA	NA	CLAY; some silt; few f-m shell fragments; trace clay lenses; dark greenish gray (10Y 3/1).
1,365	1,370	W	NA	NA	CLAY; some silt; trace f sand lenses and f sand; dark greenish gray (10Y 3/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,370	1,375	W	NA	NA	CLAY; some silt; few flat f sand lenses; trace f-m sand; dark greenish gray (10Y 3/1).
1,375	1,380	W	NA	NA	CLAY; some silt; few clay layers; trace subrounded m-c sand; dark greenish gray (10Y 3/1).
1,380	1,385	W	NA	NA	CLAY; some silt; few clay layers; trace subrounded m-c sand; dark greenish gray (10Y 3/1).
1,385	1,390	W	NA	NA	CLAY; some silt; few clay layers; dark greenish gray (10Y 3/1).
1,390	1,395	W	NA	NA	CLAY; with silt; some clay layers; dark greenish gray (10Y 3/1).
1,395	1,400	W	NA	NA	SILT; with clay; some clay lenses; trace flat f sand lenses; dark greenish gray (10Y 3/1).
1,400	1,405	W	NA	NA	SILT; with clay; some clay lenses; few flat f sand lenses; dark greenish gray (10Y 3/1).
1,405	1,410	W	NA	NA	SILT; with clay; some clay lenses; few flat f sand lenses; trace glauconitic c sand (green/gray); dark greenish gray (10Y 3/1).
1,410	1,415	W	NA	NA	CLAY: with silt; some clay lenses; trace f-m-c sand; dark greenish gray (10Y 3/1).
1,415	1,420	W	NA	NA	CLAY; with silt; few flat f sand lenses; trace f gravel (limestone); dark greenish gray (10Y 3/1).
1,420	1,425	W	NA	NA	CLAY; some silt; trace flat, hard f sand lenses; dark greenish gray (10Y 3/1).
1,425	1,430	W	NA	NA	CLAY; with silt; few clay lenses; dark greenish gray (10Y 3/1).
1,430	1,435	W	NA	NA	SILT; with clay; trace clay lenses; trace c sand and f gravel; dark greenish gray (10Y 3/1).
1,435	1,440	W	NA	NA	SILT; with clay; trace clay lenses; trace m-c sand and angular, f gravel; dark greenish gray (10Y 3/1).
1,440	1,445	W	NA	NA	SILT; with f sand; some m-c sand; trace f sand nodules; trace clay; dark greenish gray (10Y 3/1).
1,445	1,450	W	NA	NA	SILT; with fine sand; some m-c sand; some f sand nodules; trace clay; dark greenish gray (10Y 3/1).
1,450	1,455	W	NA	NA	SILT; with fine sand; some m-c sand; trace f sand nodules; trace clay; dark greenish gray (10Y 3/1).
1,455	1,460	W	NA	NA	SILT; trace f-m-c sand; trace clay; dark greenish gray (10Y 3/1).
1,460	1,465	W	NA	NA	SAND, f-m-c; with silt; few sand nodules; trace f gravel and clay; dark greenish gray (10Y 3/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,465	1,470	W	NA	NA	SAND, f-m-c; with silt; few sand nodules; trace f gravel and clay; dark greenish gray (10Y 3/1).
1,470	1,475	W	NA	NA	SILT; with f-m sand; few f sand nodules; trace clay; dark greenish gray (10Y 3/1).
1,475	1,480	W	NA	NA	SILT; some f-m sand; some shell fragments; trace f gravel; trace clay; dark greenish gray (10Y 3/1).
1,480	1,485	W	NA	NA	SILT; with clay; few larger gray f sand nodules; dark greenish gray (10Y 3/1).
1,485	1,490	W	NA	NA	CLAY; with silt; few clay lenses; trace flat, f sand lenses; dark greenish gray (10Y 3/1).
1,490	1,495	W	NA	NA	CLAY; with silt; few clay lenses; trace flat, f sand lenses; dark greenish gray (10Y 3/1).
1,495	1,500	W	NA	NA	CLAY; with silt; few clay lenses; trace flat, f sand lenses; dark greenish gray (10Y 3/1).
1,500	1,505	W	NA	NA	CLAY; with silt; trace flat lenses of packed vf and f sand; dark greenish gray (10Y 3/1).
1,505	1,510	W	NA	NA	CLAY; with silt; trace f sand nodules; trace f-m sand; dark greenish gray (10Y 3/1).
1,510	1,515	W	NA	NA	CLAY; with silt; trace f sand nodules; trace f-m-c sand; dark greenish gray (10Y 3/1).
1,515	1,520	W	NA	NA	CLAY; with silt; trace f sand nodules; trace c sand; dark greenish gray (10Y 3/1).
1,520	1,525	W	NA	NA	CLAY; with silt; few subrounded f gravel; dark greenish gray (10Y 3/1).
1,525	1,530	W	NA	NA	CLAY; with silt; nodules of dry, f sand; trace shell fragments and m sand; dark greenish gray (10Y 3/1).
1,530	1,535	W	NA	NA	CLAY; with silt; nodules of dry, f sand; trace shell fragments and m sand; dark greenish gray (10Y 3/1).
1,535	1,540	W	NA	NA	CLAY; with silt; nodules of dry, f sand; trace shell fragments; dark greenish gray (10Y 3/1).
1,540	1,545	W	NA	NA	CLAY; with silt; trace shell fragments; trace f sand nodules; dark greenish gray (10Y 3/1).
1,545	1,550	W	NA	NA	CLAY; with silt; few shell fragments; trace f sand and f sand nodules; dark greenish gray (10Y 3/1).
1,550	1,555	W	NA	NA	CLAY; with silt; trace sand and shell fragments; dark greenish gray (10Y 3/1).
1,555	1,560	W	NA	NA	SILT; with clay; trace sand and shell fragments; dark greenish gray (10Y 3/1).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,560	1,565	W	NA	NA	SILT; with clay; trace shell fragments; dark greenish gray (10Y 3/1).
1,565	1,570	W	NA	NA	SILT; with clay (some reddish brown); little f-m-c sand; trace shell fragments; dark greenish gray (10Y 3/1).
1,570	1,575	W	NA	NA	SAND, c-m-f; some silt; few to some shell fragments; trace reddish brown clay; dark greenish gray (10Y 3/1).
1,575	1,580	W	NA	NA	SAND, c-m-f; some silt; few shell fragments; trace reddish brown clay; dark greenish gray (10Y 3/1).
1,580	1,585	W	NA	NA	SAND, c-m-f; some silt; few shell fragments; trace reddish brown clay; dark greenish gray (10Y 3/1).
1,585	1,590	W	NA	NA	SAND, c-m-f; subrounded to angular f gravel (some flat, mica/shell); some silt; little reddish brown clay; dark greenish gray (10Y 3/1).
1,590	1,595	W	NA	NA	SAND, f-m-c; some silt; little f gravel; trace f sand nodules; trace flat (mica/shells); dark greenish gray (10Y 3/1).
1,595	1,600	W	NA	NA	SAND, f-m-c; little subangular to subrounded f gravel (brown); few large f sand nodules; little silt; dark greenish gray (10Y 3/1).
1,600	1,605	W	NA	NA	SAND, c-m-f; trace f sand nodules; trace rounded f gravel; dark greenish gray (10Y 3/1).
1,605	1,610	W	NA	NA	SAND, f-m-c; little silt and clay; trace rounded f gravel and f sand nodules; dark greenish gray (10Y 3/1).
1,610	1,615	W	NA	NA	SAND, f-m-c; little silt and clay; trace rounded f gravel and f sand nodules; dark greenish gray (10Y 3/1).
1,615	1,620	W	NA	NA	SAND, f-m; some silt; trace dry, f sand nodules; dark greenish gray (10Y 3/1).
1,620	1,625	W	NA	NA	SAND, m; some f-c sand; little f gravel; little silt; dark greenish gray (10Y 3/1).
1,625	1,630	W	NA	NA	SAND, m; some f-c sand; little f gravel; few nodules of rounded glauconitic f sand/clay mix (very dark gray; 2.5Y 3/1); trace silt; dark greenish gray (10Y 3/1).
1,630	1,635	W	NA	NA	SAND, f-m; little c sand; trace silt; trace glauconitic f sand; and trace clay; dark greenish gray (10Y 3/1).
1,635	1,640	W	NA	NA	SAND, c-m; some f sand; trace f gravel; dark greenish gray (10Y 3/1).
1,640	1,645	W	NA	NA	SAND, c-m; some f sand; little clay; trace f gravel and silt; dark greenish gray (10Y 3/1).
1,645	1,650	W	NA	NA	SAND, c-m; some f sand; trace f gravel and silt; dark greenish gray (10Y 3/1).

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WELL NO.:	MW-1 PAGE: 10 OF 10 PAGES

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,650	1,655	W	NA	NA	SAND, m-c; some f sand; trace gravel and silt; dark greenish gray (10Y 3/1).
1,655	1,660	W	NA	NA	SAND, m-f; little c sand; trace silt; dark greenish gray (10Y 3/1).
1,660	1,665	W	NA	NA	SAND, f; some m sand and silt; trace clay; dark greenish gray (10Y 3/1).
1,665	1,670	W	NA	NA	SILT; some clay; little f sand; trace m sand; dark greenish gray (10Y 3/1).
1,670	1,675	W	NA	NA	SILT; some clay; little f sand; trace m sand; dark greenish gray (10Y 3/1).
1,675	1,680	W	NA	NA	SILT; with f sand; some m sand; little clay; dark greenish gray (10Y 3/1).
1,680	1,685	W	NA	NA	CLAY: with silt; trace f gravel; very sloppy; dark greenish gray (10Y 3/1).
1,685	1,690	W	NA	NA	CLAY; with silt; trace m-c sand and f gravel; very sloppy; dark greenish gray (10Y 3/1).
1,690	1,695	W	NA	NA	CLAY; some silt; trace f gravel and shell fragments; very sloppy; dark greenish gray (10Y 3/1).
1,695	1,700	W	NA	NA	CLAY; little f gravel and silt; trace f-m-c sand and shell fragments; trace hard sand lenses; trace green/gray clay lenses; dark greenish gray (10Y 3/1).
1,700	1,705	W	NA	NA	CLAY; little silt; little f gravel and c sand; dark greenish gray (10Y 3/1).
1,705	1,710	W	NA	NA	CLAY; few green gray clay lenses; little silt; trace c sand and f gravel; dark greenish gray (10Y 3/1).
1,710	1,715	W	NA	NA	CLAY; little silt and f-m-c sand; trace hard f sand and silt lenses; dark greenish gray (10Y 3/1).
1,715	1,720	W	NA	NA	CLAY; little silt; little f-m-c sand and f gravel; very sloppy; dark greenish gray (10Y 3/1).
1,720	1,725	W	NA	NA	CLAY; little silt; little f-m-c sand and f gravel; very sloppy; dark greenish gray (10Y 3/1).
					EOB : 1725 ft.

DHEC
PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 898-4300

1. WELL OWNER INFORMATION:
Name: Maguro Enterprises, LLC (last) (first)
Address: 1669 Garrott Avenue
City: Moncks Corner State: SC Zip: 29461
Telephone: Work: Home:

2. LOCATION OF WELL: **COUNTY:** Berkeley
Name: MW-2
Street Address: 3203 HWY 52
City: Moncks Corner Zip:
Latitude: 33.060932 Longitude: -80.038280

3. PUBLIC SYSTEM NAME: **PUBLIC SYSTEM NUMBER:**
Not Applicable

4. ABANDONMENT: ☐ Yes ☑ No
Give Details Below
Grouted Depth: from ______ ft. to ______ ft.

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
See attached Geologic Log		

*Indicate Water Bearing Zones
(Use a 2nd sheet if needed)

5. REMARKS:

6. TYPE: ☑ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☐ Other

7. PERMIT NUMBER:

8. USE:
☐ Residential ☐ Public Supply ☐ Process
☐ Irrigation ☐ Air Conditioning ☐ Emergency
☐ Test Well ☑ Monitor Well ☐ Replacement

9. WELL DEPTH (completed) Date Started: 10/5/2014
1645 ft. Date Completed: 11/13/2014

10. CASING: ☐ Threaded ☑ Welded
Diam.: 4"
Type: ☐ PVC ☐ Galvanized ☑ Steel ☐ Other
10" in. to 1565 ft. depth
4" in. to 1615 ft. depth
Height: Above/Below Surface ______ ft.
Weight ______ lb./ft.
Drive Shoe? ☐ Yes ☐ No

11. SCREEN:
Type: ______ Diam.: ______
Slot/Gauge: ______ Length: ______
Set Between: ______ ft. and ______ ft.
______ ft. and ______ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☐ No

12. STATIC WATER LEVEL ______ ft. below land surface after 24 hours

13. PUMPING LEVEL Below Land Surface.
______ ft. after ______ hrs. Pumping ______ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: ______

14. WATER QUALITY
Chemical Analysis ☐ Yes ☐ No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

15. ARTIFICIAL FILTER (filter pack) ☐ Yes ☐ No
Installed from ______ ft. to ______ ft.
Effective size ______ Uniformity Coefficient ______

16. WELL GROUTED? ☐ Yes ☐ No
☐ Neat Cement ☐ Bentonite ☐ Bentonite/Cement ☐ Other ______
Depth: From ______ ft. to ______ ft.

17. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ______ ft. ______ direction
Type ______
Well Disinfected ☐ Yes ☐ No Type: ______ Amount: ______

18. PUMP: Date installed: ______ Not installed ☐
Mfr. Name: ______ Model No.: ______
H.P. ______ Volts ______ Length of drop pipe ______ ft. Capacity ______ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

19. WELL DRILLER: **CERT. NO.:**
Address: (Print) Level: A B C D (circle one)
Telephone No.: Fax No.:

20. WATER WELL DRILLER'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Signed: ______ Date: ______
Well Driller

If D Level Driller, provide supervising driller's name:

COPY 1 MAIL TO SCDHEC, COPY 2 TO WELL OWNER, COPY 3 TO WELL DRILLER

GEOLOGIC LOG

Leggette, Brashears & Graham, Inc.
600 East Crescent Avenue, Suite 200
Upper Saddle River, New Jersey 07458
www.lbgweb.com

CLIENT: FOX ENGINEERING ASSOCIATES, INC. and MAGURO ENTERPRISES, LLC	
WELL NO.: MW-2	
PAGE: 1 **of** 11 **PAGES**	
SITE LOCATION: Moncks Corner, South Carolina	**SCREEN TYPE:** SS Wire-Wrap **DIAMETER:** 4-inch
	SLOT NO.: 20-slot **SETTING:** 1,615-1,645 ft.bg.
DATE COMPLETED: 11/13/2014	**SAND PACK SIZE:**
DRILLING COMPANY: Layne Christensen, Co.	**SETTING:** 1,565 – 1,647 ft. bg.
	CASING TYPE: Steel **DIAMETER:** 10-inch / 4-inch
DRILLING METHOD: Mud Rotary	**SETTING:** 0-200 ft.bg. / 0-1,615 ft.bg.
SAMPLING METHOD: Wash	**SEAL TYPE:** Cement grout
OBSERVER: M. Iannacone	**SETTING:** 0- 1,565 ft. bg.
REFERENCE POINT (RP): Grade	**BACKFILL TYPE:** NA
ELEVATION OF RP: NA	**STATIC WATER LEVEL:** 51 ftbtoc **DATE:** 10/18/2014
SURFACE COMPLETION: Stick-Up	**DEVELOPMENT METHOD:** Airlift
	DURATION: ~16 hours **ESTIMATED YIELD:** 100 gpm*

COMMENTS: *estimated yield based on airlift development

ABBREVIATIONS: W = wash f = fine m = medium c = coarse ft.bg. = feet below grade EOB = End of Boring
SS = Stainless Steel ftbtoc = feet below top of casing gpm = gallons per minute

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
0	10	W	NA	NA	SAND, with silt; very hard (dried, cemented); yellowish brown.
10	20	W	NA	NA	SILT; with gray clay; some sand; trace f subangular gravel; mottled olive yellow (2.5Y 6/8) and strong brown (7.5YR 4/4).
20	36	W	NA	NA	SILT; with gray clay; some sand; trace f angular gravel; mottled olive yellow (2.5Y 6/8) and strong brown (7.5YR 4/4).
36	46	W	NA	NA	CLAY; trace silt; trace f rounded gravel; gray (5Y 6/1) with white streaks.
46	56	W	NA	NA	CLAY; some silt; gray (5y 6/1).
56	68	W	NA	NA	CLAY; little silt; few light gray clay lenses; stiff; gray (5y 6/1).
68	78	W	NA	NA	CLAY; soft trace silt lenses; gray (5y 6/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
78	88	W	NA	NA	CLAY; trace stiff silt lenses; soft; gray (5y 6/1).
88	99	W	NA	NA	CLAY; trace stiff silt lenses; soft; gray (5y 6/1).
99	109	W	NA	NA	CLAY; trace stiff silt lenses; soft; gray (5y 6/1).
109	119	W	NA	NA	CLAY; trace silt; trace m sand and angular f gravel; gray (5Y 5/1).
119	131	W	NA	NA	CLAY; little silt; few fine sand nodules; trace angular f gravel; gray (5Y 5/1).
131	141	W	NA	NA	CLAY; some f sand nodules; little silt; trace f angular gravel; gray (5Y 5/1).
141	151	W	NA	NA	CLAY; some f sand nodules; little silt; trace subrounded gravel; gray (5Y 5/1).
151	161	W	NA	NA	CLAY; some f sand nodules; little silt; trace subrounded gravel; gray (5Y 5/1).
161	172	W	NA	NA	CLAY; some f sand nodules; little silt; trace subrounded gravel; gray (5Y 5/1).
172	182	W	NA	NA	CLAY; few f sand nodules; little silt and subrounded f gravel; gray (5Y 5/1).
182	193	W	NA	NA	CLAY; with silt; few angular to subrounded gravel; and f sand nodules; gray (5Y 5/1).
193	203	W	NA	NA	SAND, f; trace m-c sand; light brownish gray (2.5Y 6/2)
203	213	W	NA	NA	CLAY; some angular c sand and gravel; grayish brown (2.5Y 5/2).
213	223	W	NA	NA	CLAY; some angular c sand and gravel; grayish brown (2.5Y 5/2).
223	233	W	NA	NA	CLAY; little silt; trace angular f gravel; grayish brown (2.5Y 5/2).
233	243	W	NA	NA	SAND, f; trace subrounded f gravel; dark gray (5Y 4/1).
243	253	W	NA	NA	SAND, f; trace f sand nodules (gravel sized); dark gray (5Y 4/1).
253	263	W	NA	NA	SAND, f-m-c; with limestone and shell fragments (gray (2.5Y 6/1).
263	273	W	NA	NA	SAND, f; grayish brown (2.5Y 5/2).
273	283	W	NA	NA	SAND, f; grayish brown (2.5Y 5/2).
283	293	W	NA	NA	SAND, f; grayish brown (2.5Y 5/2).
293	306	W	NA	NA	SAND, f; grayish brown (2.5Y 5/2).
306	316	W	NA	NA	SAND, f; some m sand; gray (5Y 5/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
316	326	W	NA	NA	SAND, f-m; some shell fragments and limestone pieces; trace c sand; dark gray (2.5Y4/1).
326	336	W	NA	NA	SILT; some f-m-c sand; little shell fragments; very dark gray (5Y 3/1).
336	346	W	NA	NA	SILT; some f-m-c sand; little shell fragments; very dark gray (5Y 3/1).
346	356	W	NA	NA	SILT; some f-m-c sand and clay; little shell fragments; very dark gray (5Y 3/1).
356	366	W	NA	NA	CLAY; with silt; trace f-m sand; very dark gray (5Y 3/1).
366	376	W	NA	NA	CLAY; with silt; trace f-m sand; trace light gray, stuff clay lenses; very dark gray (5Y 3/1).
376	396	W	NA	NA	SAND, f-m-c; some silt; little shell fragments and f gravel; black (5Y 2.5/1).
396	416	W	NA	NA	CLAY; with silt; trace f-m-c sand and shell fragments; stiff; black (5Y 2.5/1).
416	436	W	NA	NA	CLAY; with silt; trace f-m-c sand and shell fragments; trace gray clay lenses; stiff; black (5Y 2.5/1).
436	452	W	NA	NA	CLAY; with silt; trace f-m-c sand and shell fragments; trace gray clay lenses; stiff; black (5Y 2.5/1).
452	472	W	NA	NA	CLAY; some silt; trace sand; black (5Y 2.5/1).
472	492	W	NA	NA	CLAY; some silt; trace sand; black (5Y 2.5/1).
492	512	W	NA	NA	CLAY; some silt; trace sand; stiff; black (5Y 2.5/1).
512	532	W	NA	NA	CLAY; high plasticity; soft; black (5Y 2.5/1).
532	552	W	NA	NA	SAND, f-m; some silt; little clay; trace shell fragments and c sand; trace hard, f sand nodules; black (5Y 2.5/1).
552	572	W	NA	NA	SILT; little f-m-c sand and clay; trace gray clay lenses and trace black f gravel; very dark greenish gray (10Y 3/1).
572	592	W	NA	NA	SILT; some f sand; little m-c sand and clay; trace shell fragments; very dark greenish gray (10Y 3/1).
592	612	W	NA	NA	SILT; some f sand; little m sand; trace f sand nodules and f gravel; very dark greenish gray (10Y 3/1).
612	632	W	NA	NA	SILT; little f-m sand; trace c sand; very dark greenish gray (10Y 3/1).
632	652	W	NA	NA	SILT; little f-m sand; trace c sand; very dark greenish gray (10Y 3/1).
652	672	W	NA	NA	SILT; with gray clay; trace sand; very dark greenish gray (10Y 3/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
672	692	W	NA	NA	SILT; with gray clay; trace sand; very dark greenish gray (10Y 3/1).
692	712	W	NA	NA	SILT; with gray clay; trace sand; very dark greenish gray (10Y 3/1).
712	732	W	NA	NA	SILT; with gray clay; trace sand; very dark greenish gray (10Y 3/1).
732	752	W	NA	NA	CLAY; some silt; very dark greenish gray (10Y 3/1).
752	772	W	NA	NA	CLAY; little silt; high plasticity, stiff; very dark greenish gray (10Y 3/1).
772	792	W	NA	NA	SAND, f; very dark greenish gray (10Y 3/1).
792	812	W	NA	NA	SILT; with clay; trace sand and subrounded f gravel; very dark greenish gray (10Y 3/1).
812	832	W	NA	NA	SAND, f; with silt; some clay; trace m sand and/or shell fragments; very dark greenish gray (10Y 3/1).
832	852	W	NA	NA	SAND, f; little silt and clay; trace m sand and shell fragments; very dark greenish gray (10Y 3/1).
852	872	W	NA	NA	SAND, f; little silt and clay; trace m sand and shell fragments; very dark greenish gray (10Y 3/1).
872	892	W	NA	NA	SILT; some f sand and clay; trace f gravel and m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
892	912	W	NA	NA	SILT; some f sand and clay; trace f gravel and m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
912	932	W	NA	NA	SAND, f; some silt; trace clay and m sand/shell fragments; very dark greenish gray (10Y 3/1).
932	952	W	NA	NA	SILT; with f sand; little clay; trace m sand and shell fragments; very dark greenish gray (10Y 3/1).
952	972	W	NA	NA	SILT; some clay and f sand; trace m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
972	992	W	NA	NA	SILT; some clay and f sand; trace m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
992	1,013	W	NA	NA	SILT; trace f-m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
1,013	1,023	W	NA	NA	SILT; with clay; trace c sand and subangular f gravel; very dark greenish gray (10Y 3/1).
1,023	1,033	W	NA	NA	SILT; with clay; trace sand and f gravel and shell fragments; very dark greenish gray (10Y 3/1).
1,033	1,043	W	NA	NA	SILT; with clay; little sand and f gravel and shell fragments; very dark greenish gray (10Y 3/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,043	1,053	W	NA	NA	SILT; some sand to f gravel and shell fragments; few hard f sand nodules; very dark greenish gray (10Y 3/1).
1,053	1,063	W	NA	NA	SILT; some sand to f gravel and shell fragments; few hard f sand nodules; very dark greenish gray (10Y 3/1).
1,063	1,073	W	NA	NA	SILT; some sand to f gravel and shell fragments; few hard f sand nodules; very dark greenish gray (10Y 3/1).
1,073	1,083	W	NA	NA	SILT; some sand to f gravel and shell fragments; few hard f sand nodules; very dark greenish gray (10Y 3/1).
1,083	1,093	W	NA	NA	SILT; little sand to f gravel and shell fragments; very dark greenish gray (10Y 3/1).
1,093	1,103	W	NA	NA	SILT; little sand to f gravel and shell fragments; very dark greenish gray (10Y 3/1).
1,103	1,108	W	NA	NA	SILT; with clay; trace sand and shell fragments; very dark greenish gray (10Y 3/1).
1,108	1,113	W	NA	NA	SILT; with clay; very dark greenish gray (10Y 3/1).
1,113	1,118	W	NA	NA	SILT; with clay; very dark greenish gray (10Y 3/1).
1,118	1,123	W	NA	NA	SILT; with clay; very dark greenish gray (10Y 3/1).
1,123	1,128	W	NA	NA	SILT; with clay; very dark greenish gray (10Y 3/1).
1,128	1,133	W	NA	NA	SILT; with clay; trace f-m sand; very dark greenish gray (10Y 3/1).
1,133	1,138	W	NA	NA	SILT; with clay; trace f-m sand; very dark greenish gray (10Y 3/1).
1,138	1,143	W	NA	NA	CLAY; with silt; trace f-m sand; very dark greenish gray (10Y 3/1).
1,143	1,148	W	NA	NA	CLAY; with silt; trace f-m sand; very dark greenish gray (10Y 3/1).
1,148	1,153	W	NA	NA	CLAY; with silt; trace f-m sand; very dark greenish gray (10Y 3/1).
1,153	1,158	W	NA	NA	CLAY; with silt; trace f-m-c sand and hard f sand nodules; trace subangular to subrounded f gravel; very dark greenish gray (10Y 3/1).
1,158	1,163	W	NA	NA	CLAY; with silt; trace f-m-c sand and hard f sand nodules; trace subangular to subrounded f gravel; very dark greenish gray (10Y 3/1).
1,163	1,168	W	NA	NA	CLAY; with silt; trace f-m-c sand and hard f sand nodules; trace subangular to subrounded f gravel; very dark greenish gray (10Y 3/1).
1,168	1,173	W	NA	NA	CLAY; with silt; trace flat, trace hard f sand lenses; trace sand and angular f gravel; very dark greenish gray (10Y 3/1).

DEPTH (FEET) FROM	TO	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
1,173	1,178	W	NA	NA	CLAY; with silt; trace flat, trace hard f sand lenses; trace sand and angular f gravel; very dark greenish gray (10Y 3/1).
1,178	1,183	W	NA	NA	CLAY; with silt; trace flat, trace hard f sand lenses; trace sand and angular f gravel; very dark greenish gray (10Y 3/1).
1,183	1,188	W	NA	NA	CLAY; with silt; trace flat, trace hard f sand lenses; trace sand and angular f gravel; very dark greenish gray (10Y 3/1).
1,188	1,193	W	NA	NA	SILT; little sand; and angular gravel; very dark greenish gray (10Y 3/1).
1,193	1,198	W	NA	NA	SILT; little sand; and angular gravel; very dark greenish gray (10Y 3/1).
1,198	1,203	W	NA	NA	SILT; little sand; and angular gravel; very dark greenish gray (10Y 3/1).
1,203	1,208	W	NA	NA	SILT; some f sand and shell fragments and/or f gravel; very dark greenish gray (10Y 3/1).
1,208	1,213	W	NA	NA	SILT; some f sand and shell fragments and/or f gravel; very dark greenish gray (10Y 3/1).
1,213	1,218	W	NA	NA	SAND, f-m; some shell fragments; little silt; trace clay; very dark greenish gray (10Y 3/1).
1,218	1,223	W	NA	NA	SAND, f-m; some shell fragments; little silt; trace clay; very dark greenish gray (10Y 3/1).
1,223	1,228	W	NA	NA	SILT; some sand and f gravel and or shell fragments; very dark greenish gray (10Y 3/1).
1,228	1,233	W	NA	NA	SILT; some sand and f gravel and or shell fragments; little clay; very dark greenish gray (10Y 3/1).
1,233	1,238	W	NA	NA	SAND, vf-f; with silt; little gray clay streaks; very dark greenish gray (10Y 3/1).
1;238	1,243	W	NA	NA	SILT; with fine sand; very dark greenish gray (10Y 3/1).
1,243	1,248	W	NA	NA	SILT; little sand; trace f gravel and shell fragments; very dark greenish gray (10Y 3/1).
1,248	1,253	W	NA	NA	SAND, vf-f; little silt; trace gray clay streaks and m-c sand; very dark greenish gray (10Y 3/1).
1,253	1,258	W	NA	NA	SAND, vf-f; some silt; trace gray clay streaks and f gravel; very dark greenish gray (10Y 3/1).
1,258	1,263	W	NA	NA	SAND. vf-f; little silt; trace f gravel and shell fragments; very dark greenish gray (10Y 3/1).
1,263	1,268	W	NA	NA	SAND. vf-f; little silt; trace f gravel and shell fragments; very dark greenish gray (10Y 3/1).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,268	1,273	W	NA	NA	SAND, vf-f; some silt; trace gravel and shell fragments; very dark greenish gray (10Y 3/1).
1,273	1,278	W	NA	NA	SAND, vf-f; some silt; trace f gravel; trace gray clay streaks; very dark greenish gray (10Y 3/1).
1,278	1,283	W	NA	NA	SAND, f; little silt; little f sand nodules and shell fragments; very dark greenish gray (10Y 3/1).
1,283	1,288	W	NA	NA	SAND, f; little silt; little f sand nodules and shell fragments; trace light gray clay streaks; very dark greenish gray (10Y 3/1).
1,288	1,293	W	NA	NA	SAND, f; little silt; little f sand nodules and shell fragments; trace light gray clay streaks; very dark greenish gray (10Y 3/1).
1,293	1,298	W	NA	NA	SAND, f; little silt; trace m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
1,298	1,303	W	NA	NA	SAND, f; little silt; trace m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
1,303	1,308	W	NA	NA	SILT; with f sand; trace m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
1,308	1,313	W	NA	NA	SILT; little sand and shell fragments; very dark greenish gray (10Y 3/1).
1,313	1,318	W	NA	NA	SILT; some sand and shell fragments; trace f gravel (friable); very dark greenish gray (10Y 3/1).
1,318	1,323	W	NA	NA	SAND, f; little silt; trace m sand and shell fragments; very dark greenish gray (10Y 3/1).
1,323	1,328	W	NA	NA	SILT; some sand; shell fragments and friable f gravel; trace clay lenses; very dark greenish gray (10Y 3/1).
1,328	1,333	W	NA	NA	SILT; with sand; some shell fragments; little f gravel; trace clay lenses; very dark greenish gray (10Y 3/1).
1,333	1,338	W	NA	NA	SAND, m-c-f; with silt; little shell fragments and f gravel; very dark greenish gray (10Y 3/1).
1,338	1,343	W	NA	NA	SAND, m-c-f; with silt; little shell fragments and f gravel; trace clay lenses; very dark greenish gray (10Y 3/1).
1,343	1,348	W	NA	NA	SAND, m-c-f; with silt; little shell fragments and f gravel; trace clay lenses; very dark greenish gray (10Y 3/1).
1,348	1,353	W	NA	NA	SAND, c-m-f; with shell fragments; some silt; little f gravel; very dark greenish gray (10Y 3/1).
1,353	1,358	W	NA	NA	SAND, f; trace shell fragments; well-sorted; dark gray (N 4/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,358	1,363	W	NA	NA	SAND, f; trace shell fragments; well-sorted; dark gray (N 4/1).
1,363	1,368	W	NA	NA	SAND, m-f; with silt; little c sand and shell fragments; few light gray clay lenses; trace friable f gravel; dark greenish gray (10Y 4/1).
1,368	1,373	W	NA	NA	SAND, m-f; with silt; little c sand and shell fragments; few light gray clay lenses; trace friable f gravel; dark greenish gray (10Y 4/1).
1,373	1,378	W	NA	NA	SAND, m-f; with silt; little c sand and shell fragments; few light gray clay lenses; trace friable f gravel; dark greenish gray (10Y 4/1).
1,378	1,383	W	NA	NA	SAND, m-f; with silt; little c sand and shell fragments; few light gray clay lenses; trace friable f gravel; dark greenish gray (10Y 4/1).
1,383	1,388	W	NA	NA	SAND, m-f; with silt; little c sand and shell fragments; few light gray clay lenses; trace friable f gravel; dark greenish gray (10Y 4/1).
1,388	1,393	W	NA	NA	SILT; some f-m sand; little f gravel and c sand and shell fragments; trace brown, gray, tan clay lenses; dark greenish gray (10Y 4/1).
1,393	1,398	W	NA	NA	SILT; some f-m-c sand and clay; little shell fragments; and f gravel; dark greenish gray (10Y 4/1).
1,398	1,403	W	NA	NA	SILT; some gray and tan clay lenses and streaks; trace shell fragments and f gravel; little f-m-c sand; dark greenish gray (10Y 4/1).
1,403	1,408	W	NA	NA	SILT; some clay; little f sand; trace m sand and shell fragments; dark greenish gray (10Y 4/1).
1,408	1,413	W	NA	NA	SILT; some clay; little f-m sand; trace c sand; f gravel, and shell fragments; dark greenish gray (10Y 4/1).
1,413	1,418	W	NA	NA	CLAY; little silt; very dark greenish gray (10Y 3/1).
1,418	1,423	W	NA	NA	CLAY; little silt; trace sand; very dark greenish gray (10Y 3/1).
1,423	1,428	W	NA	NA	CLAY; with silt; little vf- f sand; very dark greenish gray (10Y 3/1).
1,428	1,433	W	NA	NA	SILT; with clay; little vf- f sand; very dark greenish gray (10Y 3/1).
1,433	1,438	W	NA	NA	CLAY; with silt; trace vf-f sand; very dark greenish gray (10Y 3/1).
1,438	1,443	W	NA	NA	CLAY; some silt; trace f-m sand; very dark greenish gray (10Y 3/1).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,443	1,448	W	NA	NA	CLAY; some silt; few f sand nodules; trace m sand, f gravel and shell fragments; very dark greenish gray (10Y 3/1).
1,448	1,453	W	NA	NA	SILT; with clay; some vf-f sand; few clay lenses; trace m-c sand and subrounded f gravel; very dark greenish gray (10Y 3/1).
1,453	1,458	W	NA	NA	SAND, vf-f; some silt; very dark greenish gray (10Y 3/1).
1,458	1,463	W	NA	NA	SAND, f; trace shell fragments and m sand; well sorted; very dark greenish gray (10Y 3/1).
1,463	1,468	W	NA	NA	SILT; with clay; trace f-m-c sand; very dark greenish gray (10Y 3/1).
1,468	1,473	W	NA	NA	SILT; with clay; trace f-m-c sand; very dark greenish gray (10Y 3/1).
1,473	1,478	W	NA	NA	CLAY; little silt; trace angular f gravel and sand; very dark greenish gray (10Y 3/1).
1,478	1,483	W	NA	NA	CLAY; little silt; trace angular f gravel and sand; very dark greenish gray (10Y 3/1).
1,483	1,488	W	NA	NA	CLAY; little silt; trace angular f gravel and sand; very dark greenish gray (10Y 3/1).
1,488	1,493	W	NA	NA	CLAY; little silt; trace angular f gravel and sand; very dark greenish gray (10Y 3/1).
1,493	1,498	W	NA	NA	CLAY; little silt; trace angular f gravel and sand; very dark greenish gray (10Y 3/1).
1,498	1,503	W	NA	NA	CLAY; little silt; trace angular f gravel and sand; very dark greenish gray (10Y 3/1).
1,503	1,508	W	NA	NA	CLAY; little silt; trace angular f gravel and sand; very dark greenish gray (10Y 3/1).
1,508	1,513	W	NA	NA	CLAY; little silt; trace angular f gravel and sand; very dark greenish gray (10Y 3/1).
1,513	1,518	W	NA	NA	SAND, f; little silt; trace m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
1,518	1,523	W	NA	NA	SILT; with clay; trace f-m-c sand; very dark greenish gray (10Y 3/1).
1,523	1,528	W	NA	NA	SILT; with clay; little f-m-c san and shell fragments; very dark greenish gray (10Y 3/1).
1,528	1,533	W	NA	NA	SILT; with f sand; little clay; very dark greenish gray (10Y 3/1).
1,533	1,538	W	NA	NA	SAND, f; some silt; trace m sand; very dark greenish gray (10Y 3/1).

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DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,538	1,543	W	NA	NA	SAND, f; some silt; trace m sand; very dark greenish gray (10Y 3/1).
1,543	1,548	W	NA	NA	SAND, f; trace m sand and shell fragments; very dark greenish gray (10Y 3/1).
1,548	1,553	W	NA	NA	SAND, f; little m sand; trace pink c sand; very dark greenish gray (10Y 3/1).
1,553	1,558	W	NA	NA	SAND, vf-f; some silt; trace m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
1,558	1,563	W	NA	NA	SAND, vf-f; some silt; trace m-c sand; very dark greenish gray (10Y 3/1).
1,563	1,568	W	NA	NA	SAND, vf-f; with silt; trace m-c sand; very dark greenish gray (10Y 3/1).
1,568	1,573	W	NA	NA	SAND, vf-f; some silt; very dark greenish gray (10Y 3/1).
1,573	1,578	W	NA	NA	SILT; with vf-f sand; few clay lenses; trace subrounded f gravel and m-c sand; very dark greenish gray (10Y 3/1).
1,578	1,583	W	NA	NA	SAND, vf-f; little silt; trace m-c sand and shell fragments; very dark greenish gray (10Y 3/1).
1,583	1,588	W	NA	NA	SAND, vf-f; with silt; trace m-c sand and shell fragments; dark greenish gray (10Y 4/1).
1,588	1,593	W	NA	NA	SAND, f-m; little silt; trace shell fragments and c sand; dark greenish gray (10Y 4/1).
1,593	1,598	W	NA	NA	SAND, m-f; some c sand; few shell fragments; trace silt; dark greenish gray (10Y 4/1).
1,598	1,603	W	NA	NA	SAND, m-f; some c sand; few shell fragments; trace silt; dark greenish gray (10Y 4/1).
1,603	1,608	W	NA	NA	SAND, f-m; trace shell fragments and c sand; dark greenish gray (10Y 4/1).
1,608	1,613	W	NA	NA	SAND, f; some m sand and silt; trace shell fragments; dark greenish gray (10Y 4/1).
1,613	1,618	W	NA	NA	SAND, f; little m sand; trace shell fragments and silt; dark greenish gray (10Y 4/1).
1,618	1,623	W	NA	NA	SAND; m-f-c; little subrounded f gravel and shell fragments; trace silt; dark greenish gray (10Y 4/1).
1,623	1,628	W	NA	NA	SAND; m-f-c; little shell fragments and subrounded f gravel; trace silt; dark greenish gray (10Y 4/1).
1,628	1,633	W	NA	NA	SAND; m-f-c; little shell fragments; trace silt and subrounded f gravel; dark greenish gray (10Y 4/1).
1,633	1,638	W	NA	NA	SAND; m-c; some f sand; trace shell fragments and subrounded f gravel; dark greenish gray (10Y 4/1).

DEPTH (FEET)		SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DESCRIPTION
FROM	TO				
1,638	1,643	W	NA	NA	SAND; m-c; some f sand; trace shell fragments and subrounded f gravel; dark greenish gray (10Y 4/1).
1,643	1,648	W	NA	NA	SAND; m-c; some f sand; trace shell fragments and subrounded f gravel; dark greenish gray (10Y 4/1).
1,648	1,653	W	NA	NA	SAND, m-c-f; little silt; trace f gravel and shell fragments; dark greenish gray (10Y 4/1).
1,653	1,658	W	NA	NA	SAND, m-c-f; little silt; trace f gravel and shell fragments; dark greenish gray (10Y 4/1).
1,658	1,663	W	NA	NA	SAND, m-c-f; little silt; trace f gravel and shell fragments; dark greenish gray (10Y 4/1).
1,663	1,668	W	NA	NA	SAND, m-c-f; little silt; trace f gravel and shell fragments; dark greenish gray (10Y 4/1).
1,668	1,673	W	NA	NA	SAND, m-c-f; little silt; trace f gravel and shell fragments; dark greenish gray (10Y 4/1).
1,673	1,678	W	NA	NA	SAND; m-c-f; little silt; trace shell fragments; dark greenish gray (10Y 4/1).
1,678	1,683	W	NA	NA	SAND; m-c-f; little silt; trace shell fragments; dark greenish gray (10Y 4/1).
1,683	1,688	W	NA	NA	SAND; m-c-f; little silt; trace shell fragments; dark greenish gray (10Y 4/1).
1,688	1,693	W	NA	NA	SAND; m-c-f; little silt; trace shell fragments; dark greenish gray (10Y 4/1).
1,693	1,698	W	NA	NA	SILT; with clay and sand; dark greenish gray (10Y 4/1).
1,698	1,703	W	NA	NA	SILT; with clay and sand; dark greenish gray (10Y 4/1).
1,703	1,708	W	NA	NA	SILT; with clay and sand; dark greenish gray (10Y 4/1).
1,708	1,713	W	NA	NA	SAND, f-m-c; little silt; dark greenish gray (10Y 4/1).
1,713	1,718	W	NA	NA	SAND, f-m-c; little silt; very dark greenish gray (10Y 3/1).
1,718	1,723	W	NA	NA	SAND; with clay and silt; very dark greenish gray (10Y 3/1).
1,723	1,728	W	NA	NA	SAND, f-m-c; little clay and silt; greenish gray (10Y 5/1).
1,728	1,733	W	NA	NA	CLAY, with sand; some silt; trace shell fragments; greenish gray (10Y 5/1).
1,733	1,738	W	NA	NA	CLAY, with sand; some silt; trace shell fragments; greenish gray (10Y 5/1).
					EOB: 1738'

APPENDIX B

MODEL OUTPUT FILES

APPENDIX III - BEST MANAGEMENT PLAN

Maguro Enterprises, LLC – Berkeley County

Maguro submits the following information in accordance with the requirements of S. C. Code Reg. 61-113.E.2.j:

Reasonable and Appropriate Conservation (R. 61-113.E.2.j.1)

Techniques/Applications

A cooling tower uses evaporation to lower the temperature of water that conveys heat from mechanical equipment. As cooling water evaporates, concentrations of dissolved solids in the remaining water increase, reducing the ability of the water to cool the systems safely and effectively. "Blowdown" is the discharge of "spent" cooling tower water to waste (e.g. the sanitary sewer). As water from the cooling system is lost through evaporation (cooling), drift (non-cooling water loss from windage - extremely minimal), or blowdown (spent cooling water with increased dissolved solids typically discharged to waste), additional water is added to the cooling system to maintain operating levels in the cooling tower basin. This additional water is referred to as "tower make-up water."

The most significant opportunity for water conservation in cooling tower operations is to reduce the amount of water that is lost from the system as blowdown, which would result in the increase in tower make-up water efficiency. A measure of water-use efficiency is cycles of concentrations (CofC). CofC indicates the number of times water is cycled through the system before it needs to be released as blowdown. Proper chemical treatment and monitoring of the cycled water can increase the number of CofC within the system, minimizing the amount of tower make-up water required to replace blowdown losses.

Maguro is investing at least $2,000,000.00 to install a new ion exchange water treatment system that effectively limits the concentration of dissolved solids and increases the CofC. The result of this application will nearly eliminate the production of blowdown, which produces over 99% of the total waste of the cooling process. This program had been tested by Maguro as a pilot project and is proven to be successful.

Maguro's implementation of ion exchange will further maximize efficiency by incorporating the following:

- Use of water quality monitoring systems and automatic blowdown minimization through treatment techniques to maximize the CofC based on measured water quality parameters.
- Installation of meters connected to the Building Management System to measure make-up and blowdown water quantities.
- Appropriate use of automated control procedures including conductivity metering to control blowdown, treatment needs, pH monitoring, and automatic shutdown of system when not in use.
- Use of shielding or other equipment to minimize loss through drift.
- Side stream filtration of sediment and suspended solids that may foul equipment.
- Prevention of bio-growth by use of biocides.
- Use of corrosion inhibitors to inhibit corrosion of system components.

Alternate Sources of Water

Maguro supplemented its permit application with a "Water Supply Alternatives Analysis" (*See* Appendix I.) Maguro evaluated the following water sources in advance of submittal of its permit application to increase its groundwater withdrawal from 0.5 MGD to 1.5 MGD: 1) increasing its contract with Berkeley County Water and Sanitation ("BCWS") to purchase additional potable water; 2) direct withdrawal and treatment from surface water sources; 3) additional harvesting of stormwater collected on site; 4) greywater from Berkeley County Water and Sanitation; and 5) groundwater.

As is discussed in Appendix I, while Maguro is pursuing the purchase of additional water from BCWS, the complexity of bringing the necessary volume of water to the data center has caused delays in implementation of this alternative, since additional infrastructure extending several miles is needed. Moreover, there is uncertainty as to the timeline when BCWS can provide the amount of water that expansion of the data center demands. Similar issues exist with greywater, although Maguro continues to evaluate those alternatives for long-term planning purposes. Maguro currently collects stormwater on site and utilizes stormwater as a supplementary source for cooling water but there is insufficient stormwater to address the water demand upon expansion of the data center. It is estimated that only 59% of the stormwater collected on site can be used, which on average amounts to only 116 million gallons per year.

As noted in Appendix I, publically available potable water is Maguro's main source of cooling water now, and is intended to be a primary source for the life of the site. However, the proposed expansion necessitates the identification of a water source that is readily available, consistent, reliable, and sustainable and groundwater is the only water source that satisfies this analysis. For purposes of Maguro's best management practices, however, Maguro intends to utilize all available water sources in an efficient and environmentally sensitive manner.

Documentation that Proposed Water Use is Necessary to the Anticipated Needs of the Applicant (R. 61-113.E.2.j.2.b)

Industry Type

Maguro is in the Internet Software/Services Industry and Technology Services Sector.

Anticipated Growth

Maguro's plans for growth and expansion in South Carolina are proprietary and classified as "trade secrets" in accordance with S. C. Code Sec. 30-4-40(a)(1). Information related to anticipated growth is provided under separate cover, labeled "PROPRIETARY/TRADE SECRETS," for review by only appropriate staff and personnel at the South Carolina Department of Health and Environmental Control ("DHEC").

Annual Water Use Statistics

Maguro's annual water use statistics are proprietary and classified as "trade secrets" in accordance with S. C. Code Sec. 30-4-40(a)(1). Information related to annual water use statistics is provided under separate cover, labeled "PROPRIETARY/TRADE SECRETS," for review by appropriate staff and personnel at DHEC.

Maintenance Schedule (R. 61-113.E.2.j.3)

Maguro will develop and implement an Operations and Maintenance Plan, to include a schedule of maintenance, to ensure efficiency and increases in the CofC. Maguro's operations and maintenance will include the following:

- A Sequence of Operations log for each Cooling Tower system, including information regarding cooling capacity design heat loads for each tower, descriptions of the cooling tower service area, and system requirements for cooling including temperature, volume, and duration of flows (hours/day).
- Water use records for each tower that includes the number of gallons of blow-down and the number of gallons of tower make-up water used each day.
- Records of cycles of concentration and calculation data for each Cooling Tower System.
- Operation procedures for any automatic controls used to determine blowdown treatment/cycling rates, such as meters, conductivity sensors, or pH sensors.
- Descriptions of chemical compounds and amounts used to improve water quality and maximize water usage and data of chemical demand rates.
- A Maintenance Plan for all components including coils, fans, condensers, and chemical feed equipment that includes a schedule for maintenance and replacement in accordance with the Manufacturers' specifications.

Beneficial Use/Reasonable Needs (R. 61-113.E.2.j.4)

"Beneficial use" is defined as "[t]he use of that amount of water that is reasonable and appropriate under reasonably efficient practices to accomplish without waste the purpose for which the appropriation is lawfully made." *See* "Initial Groundwater Management Plan for the Trident Capacity Use Area" p. 3 (the "Plan"). "Industrial process water" is defined in the Plan as a groundwater withdrawal category: "Water used for commercial and industrial purposes, including fabrication, processing, washing, in-plant conveyance and **cooling** … ." (p. 12.)

The conservation technique described herein – blowdown treatment/minimzation through ion exchange – addresses the necessity for "reasonably efficient practices" and no waste in order to be classified as a beneficial use.

Maguro is seeking an authorization for use of groundwater that is reasonable and appropriate for the planned expansion. Maguro's prospective use of groundwater is reasonable based on its plans to implement measures to access redundant sources and not simply rely on groundwater. Maguro's prospective use of groundwater is appropriate based on the analysis and demonstration set forth in the "Hydrogeologic Report for the Support of Groundwater Withdrawal Permit Application for 1.5 MGD for Well TW-1, Moncks Corner, South Carolina" which was submitted to DHEC with Maguro's permit application.

APPENDIX IV - TESTIMONIALS

SCDOT
South Carolina
Department of Transportation

Christy A. Hall, P.E.
Secretary of Transportation
(803) 737-0874 Fax (803) 737-2038

December 1, 2016

Google, Inc.
1600 Amphitheatre Parkway
Mountain View, California 94043
U.S.A.

To Team Google:

The South Carolina Department of Transportation (SCDOT) would like to thank Google, Inc. for its continued efforts to assist the people of South Carolina by providing the most updated pertinent information online no matter the need.

The SCDOT has used the resources of Google, Inc. numerous times to provide speedy updates to South Carolina citizens and most recently, called on Google's guidance and resources to assist in our October 2016 evacuation of the South Carolina coast during Hurricane Matthew.

In the days prior to Hurricane Matthews making landfall in South Carolina, we reached out to Google to collaborate in providing up-to-date evacuation routes, travel times, and road closures as we worked tirelessly to protect the citizens of South Carolina. Once Hurricane Matthew landed in South Carolina, we provided the Google team with additional road information and data regarding damaged public infrastructure and other storm resource information. This information was disseminated online in an extremely timely manner; and Google's assistance aided in the successful evacuation, and safe travels back home for more than three hundred thousand South Carolina citizens who were displaced by the storm.

SCDOT frequently uses your incredible resources and outstanding staff to expediently provide this information to the citizens of South Carolina. Updates are made online in a prompt manner and the concern for our State and its residents is apparent. South Carolina is fortunate to have Google, Inc. as part of our South Carolina business community.

Sincerely,

Christy A. Hall, P.E.
Secretary of Transportation

Thanks for your assistance!

SCSBA
The South Carolina School Boards Association

May 9, 2017

Ms. Lilyn Hester
Mr. Rob Sanchez
Google
1669 Garrott Avenue
Moncks Corner, SC 29461

Dear Ms. Hester and Mr. Sanchez:

On behalf of the South Carolina School Boards Association, I am honored to inform you that Google has been selected as a recipient of our *Champions for Public Education* award. The award is presented to community residents, organizations or businesses/industries whose support and contributions have significantly benefited public schools.

The Berkeley County School District Board of Trustees nominated Google because of its invaluable contributions of time and resources to support public schools. Google serves as a role model for all of South Carolina. We will work with the board and district staff to coordinate the date, time and location for the awards presentation.

The SCSBA Board of Directors joins the Berkeley County School District Board of Trustees in thanking Google for its involvement in supporting public schools and making a difference in the lives of students.

If you need additional information, please feel free to contact SCSBA Communications Manager Becky Bean at 800.326.3679.

Sincerely,

Scott T. Price

Scott T. Price
Executive Director

cc: Sally Ann Wofford, Board Chair
Deon Jackson, Interim Superintendent
Dr. Donald Porter, Director of Communications and Community Engagement
Aimee Murray, Communication and Community Engagement Officer
Penny Riddle, Superintendent Secretary